

TECHNICAL SPECIFICATIONS

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SECTION 01050 SURVEY WORK

PART 1 - GENERAL

1.01 Datum

- A. Vertical and horizontal datum are based on the coordinates and benchmarks shown on the Drawings. The Contractor shall establish other vertical and horizontal control from these Owner furnished reference points as required to properly lay out and construct the Work. All connections shall be installed based on actual elevations of existing structures to which connections are made.

1.02 Lines and Grades

- A. The Contractor shall lay out all work, including structures and pipelines, and shall be responsible for any errors resulting therefrom. In all questions arising as to proper location of lines and grades, the Owner's decision will be final.
- B. As part of the bid price for the construction of the improvements the Contractor shall provide and be responsible for the layout of all work specified in the contract.
1. All Contractor surveying shall be done by a Professional Land Surveyor licensed in the State of California to perform these services.
 2. Contractor shall submit the surveyor's credentials prior to any layout work.
 3. The Contractor shall provide all necessary surveys, field staking, and positioning for the construction of all components at the proper alignment, elevations, grades, and positions, as indicated on the Drawings and as required for proper operation and function. The Contractor shall stake the work limits.
- C. The Contractor's layout shall be based upon existing structures and the vertical and horizontal datum established by the Owner.
- D. The Contractor shall supply such labor as required, at no extra charge, to aid and assist the Owner's Representative in checking line, location and grades of the work as set by the Contractor, if requested by the Owner's Representative. Work shall include moving materials and equipment that interfere with a clear line of sight between horizontal control points and the construction work.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

****END OF SECTION****

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SECTION 01300 SUBMITTALS

PART 1 - GENERAL

1.01 Summary

A. Section Includes:

1. Description of general requirements for Submittals for the Work.

1.02 Submittals

A. Where required by the Specifications, the Contractor shall submit descriptive information which will enable the Engineer to advise the Owner whether the Contractor's proposed materials, equipment or methods of work are in general conformance with the design concept and are in compliance with the drawings and specifications. The information to be submitted shall consist of drawings, specifications, descriptive data, certificates, samples, test results and other such information, all as specifically required in the Specifications.

B. The Contractor shall submit the following items:

1. Schedule of Submittals and Shop Drawings
2. List of Submittals, Shop Drawings, Product Data and Materials
3. Contractor's Safety Program
4. Designated Safety Supervisor
5. Designated "Competent Person(s)"
6. Schedule of Values
7. Construction Schedule
8. Substitutions List
9. Shop Drawings
10. Product Data
11. Samples
12. Material Safety Data Sheets
13. Operation and Maintenance Manuals
14. Project Closeout Information
15. Warranty Data
16. Others as Specified in the Technical Specifications
17. Manufacturer's Instructions
18. Manufacturer's Certifications and Test Reports

C. Where the Contractor is required by these Specifications to submit samples of products, the Contractor shall provide a sufficient number of physical samples to allow three (3) to be retained by the Owner's Representative of all structural and architectural products involving color, finish, texture, or the like.

D. List of Submittals:

1. Within thirty-five (35) calendar days after the Notice-to-Proceed, the Contractor shall submit a List of Submittals to the Owner's Representative for review.
 2. The List shall include all items of equipment and materials for mechanical, piping, architecture, electrical, heating and ventilating, equipment piping, and plumbing work; and the names of manufacturers with whom purchase orders have been or will be placed.
 3. The List shall be arranged in the same order as the Specifications, and shall contain sufficient data to identify all items of material and equipment the Contractor proposes to furnish. The List shall include Specification and/or Drawing references.
 4. After the submission is favorably reviewed and returned to the Contractor by the Owner's Representative, it shall become the basis for the submission of detailed manufacturer's drawings, catalog cuts, curves, diagrams, schematics, data, and information on each separate item for review as set forth in the Specifications.
- E. The Contractor shall be responsible for the accuracy and completeness of the information contained in each submittal and shall ensure that the material, equipment or method of work shall be as described in the submittal.
1. Submittals shall contain all required information, including satisfactory identification of items, units and assemblies in relation to the contract drawings and specifications.
 2. The Contractor shall verify that the material and equipment described in each submittal conforms to the requirements of the specifications and drawings.
 3. Unless otherwise approved by the Engineer, submittals shall be made only by the Contractor, who shall indicate by a signed stamp on the submittals that the Contractor has checked the submittals and that the work shown conforms to contract requirements and has been checked for dimensions and relationship with work of all other trades involved.
 4. If the information shows deviations from the specifications or drawings, the Contractor, by statement in writing accompanying the information, shall identify the deviations and state the reason(s) therefore.
 5. The Contractor shall ensure that there is no conflict with other submittals and shall notify the Engineer in each case where the Contractor's submittal may affect the work of another contractor or the Owner.
 6. The Contractor shall ensure coordination of submittals among the related crafts and subcontractors.

1.03 Submittal Transmittal Procedure

- A. General: Submittals regarding material and equipment shall be accompanied by a transmittal form from the Contractor. A separate form shall be used for each specific item, class of material, equipment, and items specified in separate, discrete specification sections for which a submittal is required. However, submittals for various items shall be made with a single form only when the items taken together constitute a manufacturer's package or are so functionally related that expediency indicates checking or review of the group or package as a whole.
- B. Submittal Identification: Each set of submittals or samples shall be attached to the submittal transmittal form.
1. The submittal number shall be made up of two parts: XXX-ZZ. The XXX shall be sequential number 001 for the first item submitted, 002 for the second, etc. The ZZ shall be the sequential number of a specific submittal or resubmittal (01 for the first submittal, 02 for the first resubmittal, etc.).

2. All submittals shall show the contract title, shall indicate the name of the vendor, and shall indicate when the equipment and/or material will be required by the construction schedule.
 3. The submittal must be adequate to permit a comprehensive review without further reference to the Contractor. The documents submitted must be separately identifiable on the Contractor's submittal transmittal form.
- C. Deviation from Contract: If the Contractor proposes to provide material or equipment which does not conform to the specifications and drawings, this shall be indicated under "deviations" on the submittal transmittal form accompanying the submittal copies.
1. If the Owner accepts such deviation, the Owner shall issue an appropriate Contract Change Order, except that, if the deviation is minor, or does not involve a change in price or in time of performance, a Change Order need not be issued.
 2. If any deviations from the Contract requirements are not noted on the submittal, the review of the shop drawing shall not constitute acceptance of such deviations.
 3. If a written variation is identified that was not brought to the attention of the Engineer, the costs shall be at the Contractor's expense.
- D. Submittal Completeness: Submittals which do not have all the information required to be submitted, including deviations, shall be considered as not complying with the intent of the contract and are not acceptable and will be returned without review.
1. A complete submittal shall contain sufficient data to demonstrate that the items comply with the Specifications, shall meet the minimum requirements for submissions cited in the technical specifications, shall include materials and equipment data and seismic anchorage certifications where required, and shall include any necessary revisions required for equipment other than first named.
- E. Review of Subsequent Resubmittals: It is considered reasonable that the Contractor shall make a complete and acceptable submittal to the Owner's Representative at least by the second submission of data. At the discretion of the Engineer costs associated with the review of any subsequent resubmittals may be borne by the Contractor. The Contractor will be billed for these costs by the Owner. Costs due may be deducted from progress payments due the Contractor by the Owner.

1.04 Submittal Review

- A. Within 14 calendar days after receipt of the submittal by the Engineer, the submittal will be reviewed by the Engineer and the Engineer will return the marked-up submittal. On complex drawings and equipment, the Engineer shall acknowledge receipt within 14 days and advise the Contractor when the submittal will be returned. The returned submittal shall indicate one of the following actions.
1. If the review indicates that the material, equipment or work method is in general conformance with the design concept and complies with the drawings and specifications, submittal copies will be marked "NO EXCEPTIONS TAKEN". In this event, the Contractor may begin to implement the work method or incorporate the material or equipment covered by the submittal.
 2. If the review indicates limited corrections are required, copies will be marked "MAKE CORRECTIONS NOTED". The Contractor may begin implementing the work method or incorporating the material and equipment covered by the submittal in accordance with the noted corrections. Where submittal information will be incorporated in operation and maintenance data, a corrected copy shall be provided. Otherwise, no resubmittal will be required.

3. If the review reveals that the submittal is insufficient or contains incorrect data, copies will be marked "REVISE AND RESUBMIT". The Contractor shall not undertake work covered by this submittal until the submittal has been revised, resubmitted and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED".
 4. If the review indicates that the material, equipment or work method is not in general conformance with the design concept or in compliance with the drawings and specifications, copies of the submittal will be marked "REJECTED - SEE REMARKS". Submittal with deviations which have not been identified clearly may be rejected. The Contractor shall not undertake work covered by such submittal until a new submittal is made and returned marked either "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED".
- B. Review of drawings, methods of work, or information regarding materials or equipment the Contractor proposes to provide shall not relieve the Contractor of responsibility for errors therein and shall not be regarded as an assumption of risks or liability by the Engineer, the Owner's Representative or the Owner, or by any officer, employee or subcontractor thereof, and the Contractor shall have no claim under the contract on account of the failure or partial failure of the method of work, material, or equipment so reviewed.
1. A mark of "NO EXCEPTIONS TAKEN" or "MAKE CORRECTIONS NOTED" shall mean that the Owner has no objection to the Contractor, upon its own responsibility, using the plan or method of work proposed, or providing the materials or equipment proposed.
 2. Favorable review of submittals does not constitute a change order to the Contract requirements.
 3. The favorable review of all submittals by the Engineer shall apply in general design only and shall in no way relieve the Contractor from responsibility for errors or omissions contained therein.
 4. Favorable review by the Engineer shall not relieve the Contractor of its obligation to meet safety requirements and all other requirements of laws, nor constitute a Contract Change Order.
 5. Favorable review by the Engineer will not constitute acceptance by the Engineer of any responsibility for the accuracy, coordination, and completeness of the submittals or the items of equipment represented on the submittals.
 6. The favorable review of shop drawings shall be obtained prior to the fabrication, delivery and construction of items requiring shop drawing submittal.

****END OF SECTION****

SECTION 01660 TESTING AND STARTUP

PART 1 - GENERAL

1.01 Description

- A. This Section provides specifications for the installation and testing of all equipment, piping, and structures. All commissioning work for the equipment installed under this Contract shall be performed by the Contractor.
- B. Waterlines shall be pressure tested, disinfected, flushed, and tested for bacteria in conformance with the City of Morgan Hill Water Design Standards and Standard Details for Construction prior to acceptance by the City.

1.02 Definitions

- A. Facility: Entire project, or agreed upon portion including all unit processes.
- B. Functional Checkout: Tests to demonstrate that installed equipment meet's manufacturer's installation, calibration, and adjustment requirements; electrical and control system requirements; and other requirements as specified.
- C. Performance Test: Clean water test of a unit process or group of unit processes to demonstrate that the system(s), including equipment, instrumentation, controls, electrical, and auxiliary components function to meet the requirements of the Contract Documents.
 - 1. Duration of Performance Test: Continuous, uninterrupted period of not less than 48 hours.
- D. Demonstration Period: Period of initial operation and shakedown after commissioning, seeding and startup of the facility or portion of a facility used to further demonstrate that the facility operation under actual loading conditions and to identify issues not readily apparent or discovered during previous testing.
 - 1. Duration of Demonstration Period: Continuous Period of not less than 30 days.

1.03 Submittals

- A. Startup and Testing Plans:
 - 1. Submit the following plans:
 - a. Functional Checkout Plan
 - b. Performance Test Plan
 - c. Demonstration Period Plan
 - 2. Describe all procedures and schedule for project testing, commissioning and startup.
 - 3. Once the Test Plans have been reviewed and accepted by the Owner's Representative, the Contractor shall produce checkout, alignment, adjustment and calibration sign-off forms for each item of equipment.
 - a. The forms will be used in the field by the Contractor and the Owner's Representative jointly to ensure that each item of electrical and mechanical equipment has been properly installed and tested.
 - 4. Submit at least 60 days prior to beginning startup activities.
 - 5. Provide testing plan with test logs for each item of equipment or each system to be tested.

6. Provide regular updates of testing and commissioning schedule. Submit on a weekly basis a 14 day look-ahead schedule at the time of testing.

B. Test Reports:

1. Submit reports of:
 - a. Functional Checkout
 - b. Performance Test
 - c. Demonstration Period
2. Results in a tabular format acceptable to the Engineer.
3. Submit certification of calibration of all instrumentation, including testing equipment before the Performance Test.

1.04 Quality Assurance

A. Installation:

1. All mechanical and electrical equipment furnished under this contract shall be installed in conformity with the details shown and specified and to the manufacturer's requirements.
2. Should a manufacturer's installation requirements conflict with specific requirements of the contract documents, the Contractor shall bring the matter to the attention of the Owner's Representative.
3. Any additional costs incurred arising out of changes authorized by the Owner's Representative to accommodate manufacturer's installation requirements will not be considered extra work.
4. Any costs, or time, incurred by the Contractor through failure to timely notify the Owner's Representative of a difference between contract documents and manufacturer's installation requirements shall be borne by the Contractor.

B. Testing:

1. General Requirements:
 - a. All materials, equipment, and work included in this contract shall be tested and inspected to insure compliance with the contract requirements.
 - b. Unless otherwise specified, all costs of testing, including temporary facilities and connections, shall be borne by the Contractor.
 - c. For the purpose of this section, equipment shall mean any mechanical, electrical, instrumentation, or other device with one or more moving parts or devices requiring an electrical, pneumatic or hydraulic connection. Installed tests for equipment, piping, structures, instrumentation, control, and electrical systems are also included in other Sections.
2. No tests specified herein shall be applied until the item to be tested has been inspected and approval by the Owner's Representative has been given for the application of such tests.
3. Tests and inspections, unless otherwise specified or accepted, shall be in accordance with the recognized standards of the industry.
4. The form of evidence of satisfactory fulfillment of all test and inspection requirements shall be, at the discretion of the Owner's Representative, either by tests and inspections carried out in the Owner's Representative's presence or by certificates or reports of tests and inspections carried out by approved persons or organizations.

5. The Contractor shall provide and use forms which include all test information, including specified operational parameters, and which shall be acceptable in content to the Owner's Representative.

1.05 Tests and Inspection:

A. General:

1. All equipment shall be tested by the Contractor and the equipment manufacturers' representatives to the satisfaction of the Owner's Representative before any facility is put into operation.
2. Tests shall be as specified herein and as recommended by the manufacturer to determine whether the equipment has been properly assembled, aligned, adjusted and connected.
3. Any changes, adjustments or replacements required to make the equipment operate as specified shall be carried out by the Contractor as part of the Work.

B. Procedures:

1. Prior to receipt of any progress payments in excess of 60 percent of the Contractor's lump sum bid for the work, the Contractor shall submit to the Owner's Representative, details of the procedures for testing and start-up of all equipment to be operated singly and together, excepting when such procedures have been covered in the specifications.
2. The procedures shall be divided into three distinct stages; Functional Checkout, Performance Tests, and Demonstration Period.
3. Testing procedures shall be designed to duplicate, as nearly as possible, all conditions of operation and shall be carefully selected to ensure that the equipment is not damaged.
4. Failure to observe these procedures may result in the non-acceptance of the subject equipment in question.

C. Test results shall be within the tolerances set forth in the detailed specification sections of the contract documents and any manufacturer's required specifications.

1. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice.
2. Where, in the case of an otherwise satisfactory installed test, any doubt, dispute, or difference should arise between the Owner's Representative and the Contractor regarding the test results or the methods or equipment used in the performance of such test, then the Owner's Representative may order the test to be repeated.
3. If the repeat test, using such modified methods or equipment as the Owner's Representative may require, substantially confirms the previous test, then all costs in connection with the repeat test will be paid by the Owner; otherwise the costs shall be borne by the Contractor.
4. Where the results of any installed test fail to comply with the contract requirements for such test, then such repeat tests as may be necessary to achieve the contract requirements shall be made by and at the expense of the Contractor

D. At a minimum the following test data shall be collected:

1. Operating voltages and amperages per phase.
2. Motor inrush current.
3. Operating pressures.
4. Operating flows.
5. Operating temperature.

6. Analog inputs and outputs during test.
7. Analytical instruments outputs during test.
8. Alarm conditions.

E. Records and Forms:

1. The Contractor shall provide signoff forms for all testing to be accomplished under this contract.
2. Sign off forms shall be provided for each item of mechanical, electrical and instrumentation equipment provided or installed under this contract and shall contain provisions for recording relevant performance data for original testing and not less than three retests.
3. Separate sections shall be provided to record values for the Functional Checkout, Performance Test, initials of representatives of the equipment manufacturers, the Contractor and the Owner's Representative.
4. Upon completion of testing, the Contractor shall furnish the Owner's Representative with the original of the sign off sheet for each equipment item.

1.06 Functional Checkout:

- A. The procedures shall incorporate all requirements of these specifications and shall proceed in a logical, step-wise sequence to ensure that all equipment has been properly serviced, aligned, connected, calibrated, and adjusted prior to operation.
- B. Functional Checkout procedures shall include, but not necessarily be limited to:
1. Electrical system testing.
 2. Instrumentation and controls testing.
 3. Piping system pressure testing and cleaning.
 4. Alignment of equipment.
 5. Initial lubrication of equipment.
 6. Cleaning of tanks, channels, basins, and all structures.
 7. Written certification by the manufacturer that the equipment has been installed in accordance with the manufacturer's instructions, requirements and recommendations; that the equipment is ready for operation and that the Owner's staff is suitably instructed in operation and maintenance of the equipment.

1.07 Manufacturer's Field Services and Certification:

A. Field Services:

1. The manufacturer shall perform field services on each equipment item.
2. Inspect system before initial start-up and certify that system has been correctly installed and prepared for start-up.
3. After the installation of the units and all appurtenances, each unit shall be subjected to a field running test under actual operating conditions. The field tests shall be made by the Contractor in the presence of and as directed by the Owner's Representative. The field tests shall demonstrate that under all conditions of operation each unit:
 - a. Has not been damaged by transportation or installation
 - b. Has been properly installed

- c. Has no mechanical defects
 - d. Is in proper alignment
 - e. Has been properly connected
 - f. Is free of overheating of any parts
 - g. Is free of all objectionable vibration
 - h. Is free of excessive noise
 - i. Is free of overloading of any parts
 - j. Shall operate as specified with the control system
 - k. Meets the performance requirements indicated
4. Any defects in the equipment or failure to meet the requirements of the Specifications shall be promptly corrected by the Contractor.

B. Manufacturer's Certification:

1. The Contractor shall submit certification letters for all equipment per requirements of Contract Documents.
2. Each letter shall be submitted on the manufacturer's letterhead and shall include the following statements that:
 - a. The signer has visited the site, inspected the equipment and installation, and certifies that the equipment is ready for operation.
 - b. The equipment has been installed in accordance with the manufacturer's requirements and is properly aligned and ready for operation.
 - c. The equipment has been serviced, lubricated and properly prepared to perform in accordance with the intent of the Contract Documents.
 - d. The controls, protective devices, instrumentation, and control panels furnished, as part of the equipment package, are properly installed, calibrated, and are ready for full time operation.
 - e. The control logic for startup, shutdown, sequencing, interlocks, remote operation, and emergency shutdown have been tested and are functioning properly.
 - f. The training of the Owner's operations and maintenance personnel has been completed and note the date and time of that training.
 - g. The manufacturer certifies that the equipment is approved for operation.

1.08 Performance Test:

A. Performance Test Requirements:

1. The Performance Test shall demonstrate the entire process system including, piping, valves, gates, controls, instrumentation, and auxiliary systems function as intended.
2. All systems and components shall be operated as a complete facility at various flow conditions, as directed by the Owner's Representative.
3. All equipment and systems shall be operated, to the greatest extent practicable, at conditions which represent the full range of operating parameters as defined by the Contract Documents.
4. The equipment shall be operated to determine equipment operating characteristics, including temperatures and vibration; to observe performance characteristics; and to permit initial adjustment of operating controls.

5. Performance Test shall include remote PLC modes of operation, alarms, and shutdowns as required in the electrical, instrumentation and controls portions of the Contract Documents.
6. Install gratings, safety chains, handrails, shaft guards, walkways and sidewalks prior to Performance Test.
7. Install all required lighting, heating, ventilation, and air conditioning for areas and processes to be included in the Performance Test.

B. Performance Test Sequencing:

1. After completion of Functional Checkout and Manufacturer's Certification.
2. Contractor shall schedule and notify the Owner XX days prior to the start date of the performance Test.
3. Contractor shall inspect and clean debris and dirt from all piping and structures.
4. Contractor shall fill all process units and liquid process systems, except those employing oil or chemicals, with either potable or recycled water, as directed by the Owner.
 - a. Unless otherwise specified, the Contractor shall provide at no expense to the Owner, all power, fuel, water, utilities, supplies, consumables, chemicals, testing media, labor and all other necessary items and work required to complete all tests specified in this section.
 - b. Coordinate with Owner's personnel for supply of test water.
 - c. Cost for testing water shall be per the Contract Documents.
 - d. All fuel and oil systems shall be filled with the specified fluid.
 - e. Test media for chemical systems shall be either the intended fluid or compatible substitute, as directed by the Owner's Representative.
 - f. Disposal methods for test media shall be subject to review by the Owner's Representative.
 - g. Contractor shall be responsible for costs for disposal of test media.
5. Upon completion of the filling operations, the Contractor shall circulate potable or recycled water, as designated by the Owner, through the completed facility for the duration of the Performance Test.
 - a. Contractor shall provide temporary pumping or piping required to recirculate water through the process units.
 - b. Remove temporary facilities after the completion of Performance Testing.

C. Performance Test Criteria

1. Should the Performance Test period be halted for any reason related to the facilities constructed or the equipment furnished under this contract, or the Contractor's temporary testing systems, the Performance Test program shall be repeated until the specified continuous period has been accomplished without interruption.
2. If, under test, any portion of the work should fail to fulfill the contract requirements and is adjusted, altered, renewed or replaced; tests on that portion when so adjusted, altered, removed or replaced, together with all other portions of the work as are affected thereby, shall, if so required by the Owner's Representative, be repeated within reasonable time and in accordance with the specified conditions.
 - a. The Contractor shall pay to the Owner all reasonable expenses incurred by the Owner as a result of repeating such tests.

3. At the conclusion of the Performance Test, the Contractor shall recheck all equipment for proper alignment, and if necessary, realign the equipment to manufacturer's standards or Contract requirements.
 - a. All equipment shall be checked for loose connections, unusual movement or other indications of improper operating characteristics.
 - b. Any deficiencies shall be corrected to the satisfaction of the Owner's Representative.
 - c. All equipment or devices which exhibit unusual or unacceptable operating characteristics shall be disassembled and inspected.
 - d. Unacceptable equipment shall then be repaired or removed from the site and replaced at no cost to the Owner.

1.09 Demonstration Period:

A. General:

1. Owner personnel will operate the facility with the assistance and coordination from the Contractor.
2. Demonstration Period shall commence when, in the opinion of the Owner's Representative, the following conditions have been met:
 - a. All equipment Functional Checkouts are complete.
 - b. Performance Testing is complete,
 - c. All Operations and Maintenance Manuals have been submitted, approved and copies have been transmitted to the Owner's operations staff.
 - d. All Operations & Maintenance training is complete.
 - e. All Manufacturer Certifications have been submitted.
3. Contractor shall schedule and notify the Owner XX days prior to the start date of the Demonstration Period. Contractor shall schedule process cut-overs or tie-ins with the Owner's Representative and Owner's operations staff.
5. Contractor shall make available its personnel, subcontractors, suppliers, and manufacturers representatives for the entire Demonstration Period.
 - a. Contractor personnel shall be onsite during normal working hours for the entire period to make necessary corrections and adjustments.
 - b. Contractor's electricians or electrical subcontractor shall be onsite during normal working hours for the entire period to make necessary corrections and adjustments.
 - c. SCADA and controls integrator shall be available to be onsite within 48 hours during the entire period to make corrections, modifications, and updates to the control system.
 - d. All other subcontractors, suppliers and manufacturer's representatives shall be available to be onsite within 48 hours during the entire period to make necessary corrections and adjustments..
6. Contractor shall provide emergency contact numbers to be available 24 hours/day during the Demonstration Period.

B. Owner shall furnish:

1. Chemicals required for startup.
2. Seeding material for all biological processes, if required, unless otherwise specified or shown.

3. Operations staff to operate the facility with support of Contractor.
 4. Labor and materials required for laboratory testing.
- C. At the end of the Demonstration Period, the Owner may issue a Substantial Completion Certificate, if in the opinion of the Owner's Representative, the following conditions have been met:
1. Corrections or adjustment to the facility as required by the Owner, Owner's Representative or Engineer to assure a reliable and completely operational facility have been made.
 2. Test reports have been submitted, reviewed, and accepted as adequate.
 3. All other Contract requirements for Substantial Completion have been fulfilled by the Contractor to the satisfaction of the Owner, owner's Representative, and Engineer.

PART 2 - PRODUCTS

2.01 Materials

A. Gages, Meters, Recorders and Monitors:

1. Gages, meters, recorders and monitors shall be provided by the Contractor as required to supplement or augment the instrumentation system provided under this contract to properly demonstrate that all equipment fully satisfies the requirements of the contract documents.
2. All devices employed for the purpose of measuring the performance of the facility's equipment and systems shall be specifically selected to provide a level of certainty consistent with the variables to be monitored.
3. All instruments shall be recently calibrated, and the Contractor shall be prepared at all times to demonstrate, through recalibration, the certainty of all instruments employed for testing purposes.
4. Calibration procedures shall in accordance with applicable standards of ASTM, ISA and IEEE.
5. The adequacy of all gages, meters, recorders and monitors shall be subject to review of the Owner's Representative.
6. All materials shall conform to current American Water Works Association Standards.

PART 3 - EXECUTION

3.01 Preparation

- A. Inspect and clean the equipment, connected piping and structures and remove debris and foreign material.
1. Flush piping. Sweep or vacuum clean all channels and structures to remove fine material.
- B. Turn rotating equipment by hand to check for binding or other improper operation.
- C. Perform cold and hot alignment to the manufacturer's recommended tolerances.
- D. Remove rust preventatives, oils or temporary protective coatings used to protect the equipment during construction.
- E. Open and close adjacent valves by hand to check for proper seating and range of motion.
- F. Electrical systems:
1. Complete insulation resistance tests on wiring.

2. Perform grounding tests as required.
3. Complete motor insulation resistance tests.
4. Verify correct rotation of motors and equipment.
5. Complete other requirements per electrical specifications.

G. Instrumentation systems:

1. Complete instrument calibration.
2. Complete instrument loop tests.
3. Test pneumatic systems for leaks.
4. Verify all control signals, operation, ranges and settings.
5. Complete other requirements per instrumentation and controls specifications.

3.02 Installation:

- A. All materials and equipment shall be installed by specialists properly skilled in the trades and professions required to assure first-class workmanship.
- B. Where required by detailed specifications, the Contractor shall cause the installation of specific equipment items to be accomplished under the supervision of factory-trained installation specialists furnished by the equipment manufacturers.
- C. The Contractor shall be prepared to document the skills and training of all workers engaged in the installation of all equipment furnished either by the Contractor or the Owner.

3.03 Testing

- A. Testing shall proceed on a step-by-step basis in accordance with the Contractor's written testing procedures.
- B. The Contractor's testing work shall be accomplished by a skilled team of specialists under the direction of a coordinator whose sole responsibility shall be the orderly, systematic testing of all equipment, systems, structures and the complete facility as a unit.
- C. Each individual step in the procedures shall be witnessed by the Owner's Representative.

****END OF SECTION****

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SECTION 01700

RESTORATION OF IMPROVEMENTS

PART 1 - GENERAL

1.01 Structures

- A. The Contractor shall remove existing structures, including paving, sidewalks, curbs, gutters, pipelines, and rip rap, as may be necessary for the performance of the work and shall rebuild the structures thus removed in as good a condition as found with the requirements specified. Concrete structures such as curbs and gutters shall be replaced from joint to joint or as directed by the Owner's Representative. The Contractor shall also repair existing structures that may be damaged as a result of the work under this contract.

1.02 Roads

- A. Unless otherwise specified, roads or other paved surfaces in which the surface is removed, broken, or damaged, or in which the ground has caved or settled during the work under this contract, shall be resurfaced and brought to the original grade and section. Requirements for paving restoration are covered in Section 02500-Asphalt Paving.

1.03 Cultivated Areas and Other Improvements

- A. Cultivated or planted areas and other surface or subsurface improvements, including irrigation systems, which are damaged by actions of the Contractor shall be restored as nearly as possible to their original condition at the Contractor's expense. Existing guard posts, barricades, and fences shall be protected and replaced if damaged. Contractor shall protect street lighting, traffic signals, telephone or other existing facilities from damage. Not all existing facilities are shown on the Drawings. Contractor shall restore all existing facilities damaged due to construction.

1.04 Restoration of Existing Installations

- A. The Contractor shall, at no cost to the Owner, immediately correct or replace existing equipment, controls, or systems that are damaged as a result of construction or Contractor operations.

1.05 Warranty of Restoration Work

- A. The Contractor shall include all restoration work under the one (1) year guarantee included in the General Conditions.

PART 2 - MATERIALS (NOT USED)

PART 3 - EXECUTION (NOT USED)

****END OF SECTION****

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SECTION 01720 RECORD DRAWINGS

PART 1 - GENERAL

1.01 General

- A. The Contractor shall provide the Owner's Representative neatly and legibly marked contract drawings showing the final horizontal and vertical location of piping, equipment, electrical conduits, outlet boxes and cables. Marking of the drawings shall be kept current and shall be done at the time the material and equipment are installed. These drawings shall be available to the Owner's Representative throughout the construction period. Final payment shall not be made until the marked up record drawings are delivered to and approved by the Owner's Representative.

1.02 Maintenance of Documents

- A. The following shall be maintained in the Contractor's field office in clean, dry, legible condition: Contract Drawings, Specifications, Addenda, approved Shop Drawings, Samples, photographs, Change Orders, other Modifications of Contract, test records, survey data, Field Orders, and all other documents pertinent to Contractor's Work.
- B. Two, full-sized sets of the Contract Drawings will be furnished to the Contractor by the Owner. These Contract Drawings shall be updated with record information and one copy of the updated record drawings shall be submitted for review to the Owner's Representative every month. The Record Drawing shall be up-to-date and its completeness shall be a precondition of the next month's partial payment request approval.
1. Mark and record field changes and detailed information contained in submittals and change orders.
 2. Record actual depths, horizontal and vertical location of underground pipes, duct banks and other buried utilities. Reference dimensions to permanent surface features.
 3. Identify specific details of pipe connections, location of existing buried features located during excavation, and the final locations of piping, equipment, electrical conduits, manholes, and pull boxes.
 4. Identify location of spare conduits including beginning, ending and routing through pull boxes, and manholes. Record spare conductors, including number and size, within spare conduits, and filled conduits.
 5. Provide schedules, lists, layout drawings, and wiring diagrams.
 6. Make annotations with erasable colored pencil conforming to the following color code:

Annotations	Color
Additions:	Red
Deletions:	Green
Comments	Blue
Dimensions:	Graphite

- C. Documents shall be available at all times for inspection by the Owner's Representative.

- D. Record documents shall not be used for any other purpose and shall not be removed from the office without approval of the Owner's Representative.
- E. The Contractor may submit additional full-sized drawings detailing record work as approved by the Owner's Representative.
- F. The Contractor shall not conceal any work until the required record drawing information has been recorded.

PART 2 - MATERIALS (NOT USED)

PART 3 - EXECUTION (NOT USED)

****END OF SECTION****

SECTION 02200 EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION

This section specifies earthwork activities consisting of excavation, filling, grading, and excess material control.

1.02 DEFINITIONS

- A. Compaction: The degree of compaction is specified as percent of relative compaction. The relative compactions refer to the maximum relative densities of dry soil obtainable at optimum moisture content.
- B. Excavation Slope: Excavation slope shall be defined as an inclined surface formed by removing material from below existing grade.
- C. Embankment Slope: Embankment slope shall be defined as an inclined surface formed by placement of material above existing grade.

1.03 QUALITY ASSURANCE

- A. References: The following documents are a part of this section insofar as they are specified and modified herein. In case of conflict between the requirements of this Section and the following documents, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
1. California Test Method 217	Method of Test for Sand Equivalent
2. ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
3. ASTM C260	Standard Specification for Air-Entraining Admixtures for Concrete
4. ASTM C535	Standard Test Method for Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
5. ASTM D420	Standard Recommended Practice for Investigating and Sampling Soil and Rock for Owner's Representative Purposes
6. ASTM D1556	Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method

- | | |
|----------------|--|
| 7. ASTM D1557 | Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft ³ (2,700 kN-m/m ³)) |
| 8. ASTM D2419 | Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate |
| 9. ASTM D4253 | Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table |
| 10. ASTM D4318 | Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils |
| 11. ASTM D6938 | Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) |
| 12. Caltrans | Standard Specifications, 2015 |

B. Tests: The Owner's Representative will take samples and perform tests for compliance with the specifications including Atterburg limits, specific gravity, sand equivalent, R-value, durability, moisture content, gradation, compaction, and density tests during placement of backfill materials to check compliance with these specifications. The Contractor shall remove surface material at locations designated by the Owner's Representative and provide such assistance as necessary for sampling and testing. The Owner's Representative may direct the Contractor to construct inspection trenches in compacted or consolidated backfill to determine that the Contractor has complied with these specifications. The City will bear the costs for sampling and testing specified in this Paragraph. The Contractor shall pay costs associated with retesting due to the Contractor's failure to comply with the specifications.

C. Submittals:

1. Submit current technical data for each type of material specified to prove compliance with the specifications.
2. Samples of fill materials to be used shall be submitted 60 days in advance of use. Samples shall consist of 1.0 cubic foot of each type of material proposed.

PART 2 - PRODUCTS

2.01 FILL MATERIALS

A. Type A: Type A fill material shall be a clean crushed granular material free from organic matter and shall conform to the following gradation:

<u>U.S. Standard Sieve Size</u>	<u>Percent by Weight Passing</u>
3/4 inch	100
3/8 inch	80-100
No. 4	55-100
No. 10	35-95
No. 40	10-55
No. 100	0-2

- B. Type B: Type B fill material shall be a select nonexpansive, granular material free from organic matter and of such size and gradation that the specified compaction can be readily obtained. Material "Atterberg" cohesive range will be defined by a liquid limit of less than 20% (% of water content) and a plasticity index of less than 10% (% of water content) and shall conform to the following gradation:

<u>U.S. Standard Sieve Size</u>	<u>Percent by Weight Passing</u>
3 inch	100
3/4 inch	80-100
No. 4	50-100
No. 10	35-95
No. 40	15-75
No. 200	5-35

- C. Type C: Type C fill material shall be unclassified material and may be obtained from excavation on the Work site. The material shall be free from peat, wood, roots, bark, debris, garbage, rubbish or other extraneous material. The maximum size of stone shall not exceed 4 inches.

- D. Type D: Drain Rock

1. Type D fill material shall be clean crushed granular material, commonly known as drain rock, conforming to the following gradation:

<u>U.S. Standard Sieve Size</u>	<u>Percent by Weight Passing</u>
1-1/2 inch	100
3/4 inch	30-75
1/2 inch	15-55
1/4 inch	0-5

2. Type D fill material shall be composed of hard, durable, and sound pieces of drain rock having a specific gravity of not less than 2.65.

- E. Type E: Type E fill material shall be pervious backfill conforming to the following gradation:

<u>U.S. Standard Sieve Size</u>	<u>Percent by Weight Passing</u>
No. 4	100
No. 50	0-100
No. 100	0-8
No. 200	0-4

- F. Type F Class 2 Aggregate Base: Type F fill material shall be 3/4-inch maximum size free from organic or other deleterious substances, in conformance with Caltrans Standard Specifications Section 26.

<u>U.S. Standard Sieve Size</u>	<u>Percent by Weight Passing</u>
1 inch	100
3/4 inch	90-100
No. 4	35-60
No. 30	10-30
No. 200	2-9

<u>Test</u>	<u>Minimum Value</u>
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<u>U.S. Standard Sieve Size</u>	<u>Percent by Weight Passing</u>
Resistance (R Value)	78
Sand Equivalent	22
Durability Index	35

2.02 CONTROLLED DENSITY FILL (CDF)

A. Provide machine tool excavatable or hand tool excavatable controlled density fill (CDF) as shown on the Drawings. Use hand tool excavatable CDF in all roadways or in areas required by the Engineer. Use machine tool excavatable CDF in all other areas.

B. Mix Design:

1. Hand tool excavatable CDF shall have a compressive strength of less than 100 psi. Machine tool excavatable CDF shall have a compressive strength of greater than 100 psi and less than 200 psi.
2. Total air content shall be between 8% and 12%.

C. Materials:

1. Cement: Type II low alkali Portland cement.
2. Coarse Aggregate: Pea gravel, 3/8-inch or less.
3. Fine Aggregate: Concrete sand.
4. Air-Entraining Admixture: ASTM C260.

D. Suggested mix design for hand excavatable CDF:

Material	Weight, lbs.	Volume, cu. ft.
Cement	94	0.48
Coarse Aggregate	2883	16.74
Fine Aggregate	931	5.61
Air		2.70
Water: 11 gallons	92	1.47
Total	4000	27

PART 3 - EXECUTION

3.01 GENERAL

A. Overexcavation:

1. At the direction of the Owner's Representative: Where the undisturbed condition of natural soils is inadequate for support of planned construction, the Owner's Representative will direct the Contractor to overexcavate to adequate supporting soils. The excavated space shall be backfilled and compacted to the specified elevation with soil materials in accordance with the table of Paragraph 3.02 of this Section.
2. Due to Contractor's Operations: Should the excavation be carried below the lines and grades specified on the drawings or should the bottom of the excavation be disturbed because of the Contractor's operations and require overexcavation and backfill, the Contractor shall backfill such excavated space with a compacted material in accordance with the table of Paragraph 3.02 of this Section. Backfill and compaction shall be at Contractor's expense.
3. As an alternative to overexcavation, the Owner's Representative may direct the Contractor to reinforce the soil with geotextiles equivalent to Mirafi Geolon HP370.

B. Removal of Obstructions:

1. The Contractor shall remove all brush, trees, logs, stumps, roots, heavy sods, heavy growth of grass, all decayed vegetative matter, fences, and all structures where the proper construction and completion of the Work require their removal. The Contractor shall also remove all rocks, stones, broken concrete and pavement, debris and all obstructions of whatsoever kind or character, whether natural or artificial, encountered in the Work.
2. Material that is removed as hereinbefore specified, and is not to be incorporated in the Work, shall be properly disposed of off the site.

C. Surplus Material:

1. Unless otherwise specified, surplus excavated material shall be disposed of in accordance with applicable ordinances and environmental requirements. The Contractor may dispose of surplus excavated material on-site with the written permission of the Owner's Representative. Spoils area left on-site shall be graded and compacted as directed by the Owner's Representative.
2. The Contractor shall satisfy himself that there is sufficient material available for the completion of the required earthwork before disposing of any material inside or outside the site. The Contractor shall replace shortage of material, caused by premature disposal of any material by the Contractor.
3. Material shall not be stockpiled to a depth greater than 5 feet above finished grade within 25 feet of any excavation or structure except for those areas designated to be preconsolidated. For these areas, the depth of stockpiled material shall be as specified. The Contractor shall maintain stability of the soil adjacent to any excavation.

D. Borrow Material: If the quantity of acceptable material from excavation is not sufficient to construct the embankments required by the work, the quantity of material needed to complete the embankments shall consist of imported borrow conforming to specified requirements.

E. Hauling: When hauling is done over highways and/or private streets, the loads shall be trimmed and the vehicle shelf areas shall be cleaned after each loading. The loads shall be watered after trimming to eliminate dust.

F. Haul Roads: If required, Contractor shall construct haul roads required to transport materials on the Work site. Alignment of haul roads shall be selected to avoid interference with concurrent construction operations and facility operations. Haul roads shall be removed after completion of embankment construction.

G. Finish Grading:

1. Finish surfaces shall be smooth, compacted and free from irregularities. The degree of finish shall be that normally obtainable with a blade-grader.
2. Finished grade will be as specified by the contours, plus or minus 0.10 foot, except where a local change in elevation is required to match sidewalks, curbs, manholes and catch basins, or to ensure proper drainage. Allowance for topsoil and grass cover, and subbase and pavement thickness shall be made so that the specified thickness of topsoil can be applied to attain the finished grade.
3. When the Work is at an intermediate stage of completion, the lines and grades shall be as specified plus or minus 0.5 foot to provide adequate drainage.
4. If the soil is to be cultivated or straw is to be incorporated into the surface, rocks larger than 2-1/2 inches in maximum dimension, roots and other debris on the surface of the slope shall be removed and disposed of prior to cultivation or placement of straw.

- H. Control of Erosion: The Contractor shall maintain earthwork surface true and smooth and protected from erosion. Where erosion occurs, the Contractor shall provide fill or shall excavate as necessary to return earthwork surfaces to the grade and finish specified.

3.02 FILL

- A. Fill material shall be placed in horizontal layers and compacted with power-operated tampers, rollers, idlers, or vibratory equipment. Material type, maximum layer depth, relative compaction, and general application are specified in the following table. Unless otherwise specified, fill material classes shall be used at those locations specified in the table column "General Application".

Fill Class	Material Type	Maximum Uncompressed Layer Depth, Inches	Minimum Relative Compaction, Percent	General Application
A1	A	8	90	Slabs on grade (other than specified for Class E1 or shown for Class D1)
A3	A	8	90	Bedding and initial backfill for pipe
B1	B	8	90	Structural backfill adjacent to structures
B2	B or F	8	90	Subsequent and final pipeline backfill
			95	Upper 1 foot of pipeline backfill in all roadways of asphalt concrete pavement
C1	B or C	8	90	Structural subgrade and general fill
D1	D	-	*	Drain rock
E1	E	8	90	Bedding for plastic pipes
F1	F	8	95	Aggregate base

3.03 EXCAVATION AND BACKFILL FOR PIPELINES AND CONDUITS

- A. Excavation:

1. Unless otherwise specified or indicated, excavation for pipelines and conduits shall be open cut. Trenching machines may be used except where their use will result in damage to existing facilities.

2. Where, in the opinion of the Owner's Representative, the undisturbed condition of the natural soils below the excavation grades indicated or specified is inadequate for the support of the planned pipeline, the Owner's Representative will direct the Contractor to overexcavate to adequate supporting soils and backfill the excavated space to the proper elevation in accordance with Paragraph 3.01.A of this Section. Should the natural foundation soils be disturbed or loosened because of the Contractor's operations, they shall be recompacted or removed and the space backfilled in accordance with Paragraph 3.01.A of this Section.
3. Unless otherwise shown, trenches shall be excavated at least 6 inches below the final elevation of the barrel of the pipe.

B. Trench Width:

1. The maximum and minimum allowable width of trench shall be as shown. The maximum width shall be inclusive of all sheeting, lagging and bracing.
2. Wherever the maximum allowable trench width is exceeded for any reason, the Contractor shall provide improved bedding and/or extra strength pipe, as directed by the Owner's Representative.
3. All pipelines shall have minimum of 6 inches bedding material below the barrel of the pipe. Bedding material shall as specified in the table of Paragraph 3.02 of this Section. Bedding shall be placed and compacted as specified for initial trench backfill and shall be placed to provide uniform support for the pipe.
4. Where, in the opinion of the Owner's Representative, stabilization of the undisturbed foundation below the 6-inch bedding of the overexcavated depth as shown is required because of the soft, spongy or unstable condition, backfill selected by the Owner's Representative shall be placed in the trench bottom in accordance with Paragraph 3.02 of this Section.

C. Initial Backfill:

1. After the pipe has been properly laid and inspected, initial backfill shall be placed around the pipe to a depth over the pipe as shown in the Drawings. Initial backfill shall be in accordance with the table of Paragraph 3.02 of this Section. The backfill material shall be placed in horizontal layers with maximum layer depth as specified in the table of Paragraph 3.02 of this Section, and compacted by power-operated tampers, rollers, or vibratory equipment to the relative compaction in accordance with same table.
2. Each layer shall be compacted to the specified relative compaction prior to placing subsequent layers. The thickness of the loose layer may be increased when in-place compaction tests satisfactory to the Owner's Representative show that the specified relative compaction can be obtained. No further backfilling will be permitted until the Owner's Representative has accepted the initial backfill.

- D. Subsequent Backfill:** Above the level of initial backfill, the trench shall be filled with material as specified in the table of Paragraph 3.02 of this Section, unless otherwise indicated on the drawings. The backfill material shall be placed as indicated on the drawings. The backfill material shall be placed in horizontal layers with maximum layer depth as specified in the table of Paragraph 3.02 of this Section, and shall have a moisture content such that the required degree of compaction may be obtained. Each layer shall be compacted by power-operated tampers,

rollers or other suitable equipment to the relative compaction as indicated in same table. Each layer shall be compacted to the specified relative compaction prior to placing subsequent layers.

3.04 PAVING SUBGRADE PREPARATION

- A. The prepared subgrade shall be scarified to a depth of at least 12 inches, moisture conditioned as necessary, and recompactd to at least 95 percent of the maximum relative compaction based on the ASTM D1557 test method.
- B. Any localized zones of soft or pumping soils observed within the excavation base should either be scarified and recompactd as discussed above or be overexcavated and replaced with Class B1 fill.
- C. Aggregate base course shall be compacted to at least 95 percent of the maximum relative compaction based on the ASTM D1557 test method.

3.05 SITE FILL

- A. Unless otherwise specified, general site fill material shall be Class C1, compacted to a relative compaction of at least 90 percent. If the existing slope in an area to be filled is greater than 5:1, the Contractor shall bench the area prior to filling.

**** END OF SECTION ****

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SECTION 02350 SHEETING, SHORING AND BRACING

PART 1 - GENERAL

1.01 SCOPE

- A. This Section provides specifications for sheeting, shoring, bracing, or other excavation supports.

1.02 REFERENCES

- A. This section references the following documents. They are part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the most stringent requirement shall prevail.

<u>Reference</u>	<u>Title</u>
OSHA	Occupation Safety and Health Act, US Department of Health
CAL OSHA	State of California Construction Safety Orders --- California State Labor Code

1.03 QUALITY ASSURANCE

A. Design Requirements:

1. Protection and trench safety: Pursuant to Section 6705 of the State Labor Code, all open excavations greater than 5 feet in depth shall be constructed with bracing, sheeting, shoring, or other equivalent method designed for the protection of life and limb. The trench excavation and support system shall comply in all respects with the requirements of Article 6, of the Construction Safety Orders of the Division of Industrial Safety. The Contractor's attention is directed to the provisions of Article 6, Subarticle 1541, of the California Construction Safety Orders for alternative shoring and sloping system. It shall be the Contractor's responsibility to provide the additional strength required to support the sides of the excavation against loads which may exceed those employed to derive the criteria set forth in the Industrial Safety Orders. The Contractor shall submit to the Owner's Representative a detailed plan showing the design of shoring, bracing, sloping, or other provisions to be made for worker protection from the hazard of caving ground during the excavation of such trench or trenches. If such plan varies from the shoring system standards, the plan shall be prepared and stamped by a California registered Civil Engineer. Plans must be accepted by the Owner's Representative. It shall be understood that the above stipulated requirements are to be considered to be the minimum to be provided. The Contractor shall be solely responsible for any and all liabilities which may arise from the Contractor's failure to provide adequate shoring, bracing or sheeting as necessary to support the excavation under any or all of the conditions of loading which may exist, or which may arise during the construction of the project.

2. Sequencing: The Contractor shall not start excavation until the trench support drawings have been returned to the Contractor. When the construction sequence of structures requires the transfer of bracing to the completed portions of any structure, the Contractor shall secure the written acceptance of the Owner's Representative prior to the installation of such bracing.

B. Submittals:

1. Trench Support Drawings: In accordance with the requirements of Section 6705 of the Labor Code of the State of California, the Contractor shall submit detailed drawings to the Owner's Representative before excavation, showing the design of shoring, bracing, sloping or other provisions to be made for worker protection from the hazard of caving ground during the excavation of any trench or trenches 5 feet or more in depth. The design shall be signed and stamped by a California registered Civil Engineer. Certification: The minimum required protection will be that described in the Construction Safety Orders of the Division of Industrial Safety. If the Contractor presents excavation plans that vary from the shoring system standards established by the Construction Safety Orders, the Plans shall be prepared, stamped, and signed by a California registered Civil Engineer.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

- A. The design, planning, installation and removal of all lagging, sheeting, shoring, sheet piling, and bracing shall be accomplished in such a manner as to maintain the undisturbed state of the soils adjacent to the trench and at and below the excavation bottom.
- B. The use of horizontal strutting below the barrel of a pipe or the use of a pipe as a support will not be permitted.
- C. Sheet piling and timbers in trench excavations shall be withdrawn in a manner so as to prevent subsequent settlement of the pipe or additional backfill loadings that might overload the pipe.

**** END OF SECTION ****

SECTION 02500 ASPHALT PAVING

PART 1 – GENERAL

1.01 WORK INCLUDED

- A. Work under this Section shall consist of furnishing all labor, material, equipment, tools, and services required for the placing and compacting of asphalt concrete pavement for roadways, berms, parking lots, and walkways to the lines, grades, and dimensions shown on the drawings and as specified herein.
- B. Also included shall be the repair and resurfacing of existing roadway and area paving damaged or removed during construction.
- C. Also included shall be application of prime coat over aggregate base surfaces and tack coat over existing asphalt concrete and concrete surfaces adjacent to the new paving.
- D. Seal coats as specified.

1.02 RELATED REQUIREMENTS (NOT USED)

1.02 REFERENCE STANDARDS

- A. Caltrans Standard Specifications, 2015
- B. The Contractor shall comply with the requirements of the Bay Area Air Quality Management District concerning cutback asphalt paving materials and application.

1.03 QUALITY ASSURANCE

To validate that specified final elevations have been provided, the contractor shall provide to the City applicable grade certificates. No separate payment will be made for providing such certification. All cost therefore shall be included in the various work item(s) requiring certification.

1.04 MEASUREMENT AND PAYMENT

- A. Unless otherwise specified in the Special Provisions, measurement and payment for paving and surfacing work required and to comply with requirements of this section shall be considered as included in the price paid for the various items of work and no separate payment shall be made therefor.

1.05 SUBMITTALS

- A. Submit the following under the Product (Information) category
 - 1. The Contractor shall cooperate with the Engineer and furnish necessary facilities for sampling and testing of all materials and workmanship. All materials furnished

and all work performed shall be subject to the City's inspection, and no materials shall be used in the construction work until it has been approved by the Engineer.

2. The Contractor shall submit a signed verification from each source of supply for each construction material employed on the project, indicating that the materials meet the Specification requirements.
3. Mix design for asphalt concrete.

PART 2 – PRODUCTS

2.01 AGGREGATE BASE

- A. Aggregate bases shall consist entirely of Class 2 material, as set forth in the Caltrans Standard Specifications, Section 26.
- B. Maximum aggregate size shall be three-fourths inches (3/4").
- C. Contractor shall provide supplier certifications concerning the gradation and durability of the aggregate base. Compaction and other tests will be done by others.

2.02 TACK COAT

- A. Material for tack coat shall consist of either:
 1. SS1h or SS1, conforming to the requirements of the Caltrans Standard Specifications, Section 94.
 2. Conform to the requirements of Caltrans Standard Specifications, Section 39.

2.03 SEAL COATS (OTHER THAN SLURRY SEAL)

- A. Material for seal coat shall consist of CSS1h, or SS1h conforming to the requirements of the Caltrans Standard Specifications, Section 94.
- B. Aggregate cover shall consist of one of the screening gradations specified in Section 37-2.02, "*Materials*," of the *Caltrans Standard Specifications*.

2.04 FOG SEAL COAT

- A. Material for fog seal coat shall consist of SS1h or SS1, conforming to the requirements of Sections 37 and 94 of the *Caltrans Standard Specifications*.

2.05 ASPHALT CONCRETE

- A. Material for asphalt concrete or plant mix shall be furnished and placed in strict conformance with Section 39-2, "*Hot Mix Asphalt*," of the *Caltrans Standard Specifications*.
- B. Asphalt binder shall conform to the requirements of Section 92, "*Asphalt Binders*," of the *Caltrans Standard Specifications*.

- C. Aggregate shall be either Type A or Type B. However, maximum aggregate size shall be one-half inch (1/2"), unless otherwise specified. For lifts of one inch (1") or less compacted thickness, and when material is placed by extrusion, maximum aggregate size shall be three-eighths of an inch (3/8").

2.07 PORTLAND CEMENT CONCRETE

Concrete shall conform to Division 3, "*Concrete*," of these Specifications.

PART 3 – EXECUTION

3.01 GENERAL

- A. These specifications shall cover newly paved areas, as well as existing pavement restoration.
- B. Where trenching or other construction activity has resulted in damage to a localized area of pavement, the damaged pavement surface shall be cut back six (6) inches beyond the damaged area.
- C. Where the damaged area extends over more than fifty (50) percent of the road width or paved area, as determined by the Engineer, the full pavement width or area shall be saw cut, excavated, removed and repaired.
- D. All city owned structures such as valve boxes, manhole frames and covers and monuments within the resurfaced areas shall be adjusted to the new grade, as necessary. Spraying of liquid asphalts and coatings will not be permitted on windy days (in excess of fifteen (15) miles per hour).

3.02 MAINTAINING TRAFFIC AND PUBLIC SAFETY

- A. During the paving operations, the Contractor shall furnish and place sufficient barricades at all cross streets to protect new surfacing from traffic until sufficiently cooled, as well as "DETOUR" signs one (1) block away from all impassable intersections. At least one (1) lane of through traffic shall remain open, and sufficient traffic cones placed between the through lane and the freshly surfaced lane to prevent traffic from using the freshly surfaced lane until sufficiently compacted and cooled.
- B. Spreader and other equipment shall be moved only on truck or trailer with pneumatic tires.
- C. In all cases, the Contractor shall be responsible for the complete protection of new surfacing from traffic until sufficiently compacted and cooled.

3.03 PAVEMENT CUTTING

- A. After backfilling and prior to paving, proper tools and equipment shall be used in marking and breaking so that the pavement shall be cut on neat straight lines parallel to the trench or roadway centerline. The asphalt pavement shall be saw cut using a concrete saw to a minimum depth of two (2) inches or one-half (1/2) the thickness thereof, whichever is greater. The pavement shall be cut back twelve (12) inches on each side of the trench or excavation wall. Any pavement damaged outside these

lines shall be re-cut and restored at the expense of the Contractor. Should voids develop under existing pavements during construction, the affected pavement shall be neatly saw cut in straight lines and replaced after the voids have been filled.

- B. All water generated from pavement cutting shall be contained and treated for sediment removal (through filtration or sedimentation) prior to discharge to the City storm drain.

3.04 PLACEMENT OF AGGREGATE BASE

- A. Aggregate bases shall be placed and compacted in accordance with Section 26, "Aggregate Bases," of the *Caltrans Standard Specifications*.

3.05 STREET CLEANING

- A. Contractor shall clean the streets to be resurfaced prior to planning of six-foot (6') wide strips adjacent to gutters and twenty-foot (20') wide transverse conform strips. Extensive cracking, potholes, and local depressions not indicated in the drawing to be repaired by Contractor will be repaired by City forces prior to resurfacing.
- B. The Contractor shall inspect the streets prior to his work and shall not proceed until they are cleaned to the City's satisfaction.

3.06 PREPARATION OF EXISTING ASPHALT CONCRETE

- A. Planning Asphalt Concrete Pavement:
 - 1. Existing asphalt concrete shall be planed at the locations and to the dimensions shown on the plans or field marked by the engineer and in accordance with these Specifications.
 - 2. Planning asphalt concrete pavement shall be performed by cold planning. The cold planning machine shall have a cutter head at least thirty (30) inches wide and shall be operated so as not to produce fumes or smoke.
 - 3. The depth, width, and shape of the cut shall be as indicated on the typical cross sections or as directed by the Engineer. The final cut shall result in a uniform surface conforming to the typical cross sections. The outside lines of the planed area shall be neat and uniform. The road surfacing to remain in place shall not be damaged in any way.
 - 4. Planed widths of pavement shall be continuous except for intersections at cross streets where the planning shall be carried around the corners and through the conform lines or as shown on the plans.
 - 5. Planning adjacent to existing manhole or other street boxes shall be within six-inches (6") minimum of the structure. Structures that are damaged as a result of Contractor activity shall be repaired or replaced to pre-construction condition at no cost to the City.
 - 6. The material planed from the roadway surface, including material deposited in existing gutters or on the adjacent traveled way, shall be immediately removed from the site of the work, and hauled and stockpiled at the location designated by

the Engineer. The removal crew shall follow within fifty (50) feet of the planer, unless otherwise directed by the Engineer.

7. Heating and Scarifying. The existing street surface indicated on the plans to be heated and scarified shall be heated by a mobile surface heater with lateral and vertical controls. These controls shall be used to control the application of heat to the desired location and prevent damage to adjacent concrete gutters. Additionally, the Contractor will protect trees and other planting from heat damage.
8. The asphalt binder shall not be charred in excess of one tenth of one percent (0.10%) and the scarified surface must show live asphalt cement as a result of the applied heat.
9. At least fifty (50) percent of the existing top two inches (2") of aggregate of the pavement being remixed shall be moved by spinning or tumbling, thus providing for the filling of cracks and turning over the work or dried faces which have lain upward. The asphalt paving remixer shall be adjustable from three-and-a-half feet (3-1/2') to twelve feet (12') in width, and passes shall be six inches (6") wider than the spreader following. The remixer shall also be of a type to remix depressions in the pavement to a depth of at least two inches (2"). The remixer shall be of the Therma-Bond type, Rola-Burner type, or approved equal. Immediately after the application of heat, the remixer shall pass over the heater surface and remix to a minimum depth of one-half inch (1/2").
10. The pavement remixer shall be adjustable in width and depth of application, and the remixed surface shall be uniformly and evenly spread without scattering, ridging, or breaking of the mineral aggregate.
11. Following the remixing, a tack coat of SS1h grade of emulsion (Asphalt Institute designation) shall be applied in accordance with Sections 39, "Hot Mix Asphalt," and 94, "Asphaltic Emulsion," of the *Caltrans Standard Specifications* at the minimum rate of one-tenth (1/10) gallon per square yard by a distributor truck meeting the *Caltrans Standard Specifications*. Immediately following the tack coat and while the remixed surface is in a softened state, asphalt concrete shall be placed. No surface shall be allowed to stand after heating, remixing, and application of tack coat, for such a period of time as to prevent proper compaction and bonding of the remixed material and the new course of plant-mixed surfacing.
12. No traffic shall be allowed to run on the scarified, remixed, tack-coated, or overlaid surface, until pavement is final-rolled and cooled below 150°F.
13. Should work be stopped before placing of the plant-mixed surface due to inclement weather, unavailability of asphalt concrete material, work stoppage at the end of the working day, etc., the surface shall be reheated and remixed at the Contractor's expense.

3.07 TACK COAT

- A. A tack coat (binder coat) shall be applied to existing asphaltic or concrete surfaces that are to receive an asphaltic overlay. Asphaltic pavement which has been exposed to the weather less than thirty (30) days need not be tack-coated. Tack coat shall be applied at a rate of two hundredths (0.02) to one tenth (0.10) gallon per square yard,

in accordance with Section 39-2.01C(3)(f), "Tack Coat," of the *Caltrans Standard Specifications*.

3.08 SEAL COAT (OTHER THAN SLURRY SEAL)

- A. Where called for in the Contract Documents or required by the Engineer, a seal coat shall be applied to new or older pavement. A seal coat shall be applied at the rate of fifteen-hundredths (0.15) to three-tenths (0.30) gallon per square yard immediately followed by aggregate cover. Aggregate cover shall be one-quarter inch (1/4") x No. 10 screening spread uniformly over the area. Screening shall be tightly rolled into binder with a five (5) ton steel-wheeled roller. After four (4) calendar days, excess screenings shall be removed by brooming, without disturbing screenings set in binder.
- B. Preparation and placement of seal shall be in accordance with Section 37-2, "Seal Coats" of the *Caltrans Standard Specifications*.

3.09 FOG SEAL COAT

- A. A fog seal coat conforming to the requirements of Section 37, "Bituminous Seals" of the *Caltrans Standard Specifications* shall be applied to asphaltic concrete pavements when specified in project plans and specifications. A fog coat shall be applied at a rate between five-hundredths (0.05) to one-tenth (0.10) gallon per square yard.

3.10 PLACEMENT OF ASPHALT CONCRETE

- A. Spreading and compacting of asphalt concrete shall be in accordance with Section 39-2, "Hot Mix Asphalt," of the *Caltrans Standard Specifications*.
- B. Pavement width and location for Collector Streets (44 feet curb to curb) and Arterial Streets (greater than 44 feet curb to curb). To assure that the pavement seam is not placed in the vehicle tire path, the pavement curb to curb shall be as follows:
 - 1. Collector Streets – Pavement seam shall be on centerline of street. Pavement width shall be a minimum of 12 feet wide either side of centerline, i.e., four (4) pavement widths are required to pave a collector street.
 - 2. Arterial Street – Pavement seam shall be on centerline of street. Pavement width shall be a minimum of 12 feet wide either side of centerline. For divided streets, pavement seams shall match the new lane markings.

3.11 ASPHALT BERM

- A. Asphalt berms shall be placed by using an extrusion machine. Berm dimensions shall be as indicated on the plans, and shall be laid true to line and grade, and of the required surface texture.

3.12 ADJUSTING MANHOLE, VALVE AND SURVEY MONUMENT COVERS TO GRADE

- A. The location of these structures, if shown on the plans, is approximate only. It shall be the Contractor's responsibility to suitably locate them prior to resurfacing.

- B. The Contractor shall identify all utilities covered during resurfacing by dimples and curb markings.
- C. All City manholes, valve covers, monument box covers, traffic signal covers, and other City service access covers shall be raised within ten (10) calendar days after resurfacing is completed. Water valves and specially designated items must be raised within five (5) working days after paving. The Contractor shall notify Pacific Gas and Electric Company, AT&T, cable television companies, and other utilities affected by the resurfacing in writing within twenty-four (24) hours after each street section (block) is paved and provide copies of the same to the Engineer.
- D. The monuments themselves shall not be disturbed.
- E. If the Contractor elects to raise the manhole cover castings by bricks and mortar, the casting shall be placed to new grade in compliance with these specifications, as outlined for a new casting. Special care shall be exercised not to spill mortar or grout. The inside surface of the raised manhole shall have a mortar finish.
- F. Manholes shall be adjusted to grade using three inch (3") thick and six inch (6") thick reinforced concrete grade rings or a combination thereof, from Hanson Pipe & Precast or approved equivalent. If the required adjustment to grade is less than three inches (3"), brick and mortar shall be used. If the required adjustment to grade is more than three inches (3") but less than six inches (6"), a three inch (3") thick reinforced concrete grade rings complemented by bricks and mortar shall be used.

**** END OF SECTION ****

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SECTION 02715 AGGREGATE BASES

PART 1 - GENERAL

1.01 REFERENCES

- A. Current Caltrans Standard Specifications Section 26.

1.02 SUBMITTALS

- A. The Contractor shall furnish material certificates signed by the material producer and the Contractor, showing compliance with the respective specifications in accordance with City Design Standards.

PART 2 - PRODUCTS

2.01 AGGREGATE BASE

- A. Aggregate base shall be Class 2 conforming to Caltrans Standard Specifications Section 26.

2.02 WATER

- A. Water used for compaction shall be clear and free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

PART 3 - EXECUTION

3.01 SPREADING AND COMPACTING

- A. Aggregate base shall be spread and compacted in accordance with Caltrans Standard Specifications Section 26. The maximum compacted thickness of any one layer of base material shall not exceed six (6) inches. The relative compaction of each layer of compacted base material shall be not less than 95 percent.
- B. The surface of the finished aggregate base at any point shall not vary more than 0.05 foot above or below the grade shown on the plans or established by the Owner's Representative.

**** END OF SECTION ****

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SECTION 03280 JOINTS IN CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 Description

- A. The work of this Section includes providing expansion joints, contact joints, and shrinkage contraction (weakened plane) joints in concrete pavement, sidewalk, curb and gutter.
- B. Related Sections
 - 03100 Concrete Formwork
 - 03310 Cast-in-Place Sitework Concrete

1.02 References

- ASTM D1751 Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
- ASTM D994 Preformed Expansion Joint Filler for Concrete (Bituminous Type)

1.03 Submittals

- A. The following shall be submitted in compliance with Section 01300-Submittals:
 - 1. Placement shop drawings showing the location and type of all joints
 - 2. Catalog cuts and samples of the preformed expansion joint filler material including complete product data

PART 2 - PRODUCTS

2.01 Pre-molded Joint Filler

- A. Pre-molded joint filler shall be either Preformed Expansion Joint Filler (ASTM D994) or Non-extruding and Resilient Filler (ASTM D1751) as indicated.

PART 3 - EXECUTION

3.01 Expansion Joints

- A. Expansion joints in concrete pavement shall be constructed in accordance with the configuration of the joint as indicated on the drawings.
 - 1. Expansion joint filler: min. 1/2 inch; max. 3/4 inch
 - 2. After concrete has been finished, a tooled edge shall be formed on each side of the expansion joint.
 - 3. Clean all concrete from the expansion joint filler.

3.02 Shrinkage Control Joints (Weakened Plane Joints)

- A. Shrinkage control joints in concrete pavement shall be a tooled or sawcut joint and comply with the configuration of the joint as indicated on the drawings.

END OF SECTION

SECTION 03300 CAST-IN-PLACE STRUCTURAL CONCRETE

PART 1 - GENERAL

1.01 Summary

A. Section Includes

1. Cast-in-place structural reinforced concrete
2. Concrete accessories

B. Related Sections

03280	Joints in Concrete Pavement
03300	Cast-in-Place Structural Concrete
03310	Cast-in-Place Sitework Concrete
09900	Coatings

1.02 References

A. American Concrete Institute (ACI)

ACI 117	Standard Tolerances for Concrete Construction and Materials
ACI 304	Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305	Hot Weather Concreting
ACI 306	Cold Weather Concreting
ACI 308	Guide to Curing Concrete
ACI 309	Consolidation of Concrete
ACI 318	Building Code Requirements for Structural Concrete
ACI 350	Environmental Engineering Concrete Structures

B. American Society for Testing and Materials (ASTM)

ASTM C31	Practices for Making and Curing Concrete Test Specimens in the Field
ASTM C33	Specification for Concrete Aggregates
ASTM C39	Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94	Specification for Ready-Mixed Concrete
ASTM C143	Test Method for Slump of Portland Cement Concrete
ASTM C150	Specification for Portland Cement
ASTM C157	Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete
ASTM C172	Standard Method of Sampling Freshly Mixed Concrete
ASTM C192	Method of Making and Curing Concrete Test Specimens in the Laboratory
ASTM C260	Specification for Air-Entraining Admixtures for Concrete

ASTM C289	Test Method For Potential Reactivity of Aggregates (Chemical Method)
ASTM C309	Specifications for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C494	Specification for Chemical Admixtures for Concrete
ASTM C618	Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C1077	Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for use in Construction & Criteria for Laboratory Evaluation

1.03 Definitions

- A. "Contractor" includes the general contractor in direct contract with the owner, subcontractor, or any tradesman responsible for construction.
- B. "Owner's Representative" includes the Inspector, Engineer of Record, or Construction Manager representing the owner's interests, and not directly compensated by the Contractor.
- C. "Cold Weather" is defined as a period when, for more than 3 consecutive days, the following conditions exist:
 - 1. Average daily air temperature is less than 40 F degrees (5 C) and
 - 2. Air temperature is not greater than 50 F degrees (10 C) for more than one-half of any 24-hour period.
- D. "Hot weather" is defined by any one of the following conditions:
 - 1. Ambient air temperature above 90 F degrees (32 C).
- E. "Mass Concrete" refers to single pour cast-in-place concrete that is greater than 2'-10" thick, or is 2'-6" thick or greater, with an area larger than 500 square feet.

1.04 Submittals

- A. General: All submittals must be provided for Engineer of Record approval at least 3 weeks prior to construction.
- B. Submit concrete mix design for each concrete type per ACI 301:
 - 1. Mix proportions
 - 2. Concrete materials
 - 3. Admixtures
 - 4. Water test results
 - 5. Waterstop samples for hydraulic structures
- C. Shrinkage test results from prior test mixes per ASMT C157 for hydraulic structures.
- D. Curing methods and product data per ACI 301.
- E. Repair procedures for repair per ACI 224.1 and ACI 301.
- F. Special procedures for hot weather concreting.
- G. Special procedures for cold weather concreting.
- H. Special procedures for mass concrete.

1.05 Quality Assurance

- A. Qualifications: All foremen supervising construction shall have a minimum of 3 years experience in similar work, and at least 3 previous projects of similar type, and shall be familiar with ACI 301.
- B. Field Testing
 - 1. Daily inspection written reports shall be provided to the Owner's Representative and engineer of record providing detailed information of work completed within 24 hours.
 - 2. During concrete placement, the following duties shall be performed by the Inspector:
 - a. Ambient air temperature test
 - b. Concrete temperature test
 - c. Concrete slump test
 - d. Collection of samples for lab testing
 - e. Confirm accuracy of batch ticket
 - 3. Pre-pour conference: after submittals have been provided and before construction has been commenced, a concrete conference shall be coordinated between the Inspector, Engineer of Record, and Contractor.
- C. Lab Testing
 - 1. Compression testing per ACI 318 chapter 5.
 - 2. Shrinkage testing per ASTM C157 for hydraulic structures.
 - a. One shrinkage test is required for the first batch of concrete, and every 500 cubic yards of fresh concrete thereafter.
 - b. Acceptance criteria is 0.035% (0.00035) shrinkage at 28 days.

1.06 Project Conditions

- A. Environmental Requirements:
 - 1. Concrete placement shall be limited to temperature ranges per ACI 301.
 - 2. Concrete placement shall be limited to weather conditions per ACI 301.
- B. Wet weather construction. Between the months of October and April, the contractor shall provide a 2" thick minimum mud-mat and sump pit at the bottom of foundation excavations that will be open for more than 72 hours prior to structural concrete placement. In all cases, where rainwater has saturated the bottom of foundation excavation grade prior to structural concrete placement, the grade shall be recompacted prior to concrete placement.

PART 2 - PRODUCTS

2.01 General

- A. Except as noted below, all products and materials used in proportioning, mixing, transport, placement, consolidation, curing, and repair shall satisfy ACI 301 and the Construction Drawings.

2.02 Materials

- A. Concrete materials
 - 1. Aggregate per ACI 301

2. Cementitious materials per ACI 301
 - a. Cement shall be portland cement.
 - b. Fly ash shall be provided at 15% minimum, 25% maximum of cementitious materials.
3. Admixtures
 - a. Provide as necessary to meet design and workability requirements
 - b. Mixes for hydraulic structures require shrinkage-reducing admixture, such as Eclipse by W.R. Grace.
- B. Water shall be potable, and have the following limitations:
 1. Chlorides (as Cl) no more than 250 mg/L per EPA method 300.
 2. Sulfates (as SO₄) no more than 250 mg/L per EPA method 300.
 3. Total dissolved solids no more than 500 mg/L per EPA method 160.
 4. Water quality shall be analyzed by EPA methods. Test results shall be provided to the Engineer of Record for the first batch of concrete, and every 500 cubic yards of fresh concrete thereafter.
- C. Curing compounds per ACI 301.
- D. Miscellaneous Materials
 1. Waterstops are Greenstreak PVC 6" tall flat ribbed.
 2. Plugs for formwork wall tie holes are Dayton Sureplug A-58.
 3. For formwork ties that are left in place, provide plastic cone spacers for 1.5 inch breakback.

2.03 Equipment

1. Equipment shall conform to ACI 301.

PART 3 - EXECUTION

3.01 Preparation

- A. Construction shall not be commenced until the applicable submittals have been approved by the Engineer of Record, and the Inspector has been scheduled.
- B. Reinforcing, embedded items, sleeves, and inserts shall be set and secured prior to fresh concrete placement. Interconnect anchor bolt groups with steel templates.
- C. Construction Joints:
 1. Construction joints shall be water-blasted prior to casting fresh concrete against existing concrete.
 2. New concrete shall not be placed adjacent to existing concrete younger than 3 days old for hydraulic structures; 2 days otherwise.
- D. Bonding agent shall not be used except where specially required on the Construction Drawings.
- E. Formwork temperature is verified per ACI 301.
- F. Subgrade or hardened concrete to be cast against conforms to ACI 301.

3.02 Installation

- A. Placement of fresh concrete in forms per ACI 301.
- B. Placement of fresh concrete on soil per ACI 301.
- C. Placement of fresh concrete shall be limited to weather constraints per ACI 301.
- D. Depositing fresh concrete per ACI 301 with the following requirements:
 - 1. For hot weather conditions, maximum time from batching to discharge shall not exceed 45 minutes.
 - 2. For normal weather conditions, maximum time from batching to discharge shall not exceed 60 minutes.
 - 3. Time between lift placement shall not exceed 30 minutes for hot weather placement; 60 minutes otherwise.
- E. Consolidate fresh concrete per ACI 301.
- F. Construction joints: Contractor shall not move construction joints from locations shown on Construction Drawings without approval by Engineer of Record.
- G. Finishing formed surfaces
 - 1. Exposed edges shall have 5/8 inch chamfers.
 - 2. Filling Tie Holes:
 - a. No sooner than 14 days after formwork removal, clean and roughen the entire tie hole, and cone taper zone where exists, using an aggressive wire brush.
 - b. Use Dayton Sure Plug A-58 to plug round tie holes on both wall faces.
 - c. Recess plug back 1.0 inches deeper than face of wall or recess cone taper.
 - d. Use Sikatop 123 Plus mortar or approved equal to fill and patch hole.
- H. Finishing Unformed Surfaces:
 - 1. Fresh concrete placement per ACI 301.
 - 2. Finishes definitions per ACI 301 with the following requirements:
 - a. Broom finish coarseness shall not exceed 1/16 inch amplitude, and shall be applied perpendicular to the predominate slope of the finished concrete.
 - b. Scratch Finish may also be termed "Roughened Surface" on the Construction Drawings.
 - 3. Finish schedule
 - a. Scratch Finish shall be applied to:
 - 1) Construction joints.
 - 2) Surfaces intended to receive bonded cementitious mixtures.
 - b. Float Finish shall be applied to:
 - 1) Walks, drives, steps, ramps, and for surfaces intended to receive waterproofing.
 - c. Trowel Finish shall be applied to:
 - 1) Exterior walking surfaces with less than 2 percent slope.
 - d. Boom Finish shall be applied to:
 - 1) Exterior walking surfaces with more than 2 percent slope.

- I. Curing shall conform to ACI 301 with the following additional requirements
 - 1. Where a protective coating will be applied to the concrete after curing, liquid (“membrane”) curing compounds shall not be used.
 - 2. Where a liquid curing compound is used, the compound shall be pigmented. Pigmentation shall be removable without special chemicals.
- J. Tolerances per ACI 117.

3.03 Protection

- A. Protection shall be per ACI 301.

3.04 Repair

- A. Repair shall be per ACI 301 with the following requirements:
 - 1. Patching mortar shall be Sikatop 123 Plus or approved equal.
 - 2. Use Sikadur 32 HiMod bonding agent or approved equal.
 - 3. Honeycombs and defects deeper than 38 mm (1.5 inches) shall require approval by Engineer of Record prior to commencing repair work.
 - 4. Cracks wider than 0.5 mm (0.02 inches) for hydraulic structures shall be repaired prior to leak testing.
 - 5. Cracks wider than 1 mm (0.04 inches) shall be repaired.

****END OF SECTION****

SECTION 03310 CAST-IN-PLACE SITEWORK CONCRETE

PART 1 - GENERAL

1.01 Summary

- A. The work of this Section includes providing finished cast-in-place concrete, sitework concrete, air placed concrete, including formwork, steel reinforcement, mixing, placing curing, and repairing.
- B. Sitework concrete includes curbs, gutters, pavements, guard post embedment, and all concrete work indicated to be sitework concrete.
- C. Related Sections
 - 03280 Joints in Concrete Pavement
 - 03300 Cast-in-Place Structural Concrete

1.02 Reference

- ACI 117 Standard Tolerances for Concrete Construction and Materials
- ACI 301 Specifications for Structural Concrete for Buildings
- ACI 318 Building Code Requirements for Structural Concrete

1.03 Submittals

- A. Submittals shall be made in compliance with Section 01300-Submittals.
- B. Required submittals shall be provided in accordance with the requirements of 03300-Cast-in-Place Structural Concrete.

1.04 Quality Control

- A. Tests on component materials, for the compressive strength of concrete, and for construction tolerances shall be performed in accordance with the requirements of 03300-Cast-in-Place Structural Concrete.
- B. Inspection: Prior to casting concrete or setting reinforcing, the geotechnical engineer of record shall observe and approve the subgrade.

PART 2 - PRODUCTS

2.01 Concrete Materials

- A. Concrete component materials, including curing materials and joint materials shall be in accordance with Section 03300-Cast-in-Place Structural Concrete, with the exception that all cast-in-place sitework concrete shall be 5 sack (minimum) and shall have developed a minimum compressive strength of 2,500 pounds per square inch at 28 days.
- B. Abandoned formwork. Except where explicitly shown on the Contract Documents, formwork shall not be left in place.

PART 3 - EXECUTION

3.01 General

- A. Proportioning and mixing, preparation of surfaces for concreting, handling, transporting and placing concrete, finishing and curing concrete surfaces and related procedures shall be performed in accordance with Section 03300-Cast-in-Place Structural Concrete.
- B. Concrete shall not be cast in a line longer than 70 feet in a single day.
- C. Delays between adjacent pours shall be at least 48 hours.
- D. Sitework concrete cast against structural concrete shall be separated by building paper or other barrier to prevent bond, except as explicitly shown on the Drawings.
- E. For non-structural paving, no single placement shall exceed 200 square feet or 14 feet in any direction without a shrinkage contraction joint, unless noted otherwise on the Drawings.

****END OF SECTION****

SECTION 09900 PROTECTIVE COATING SYSTEMS

PART 1 - GENERAL

1.01 Summary

A. Scope:

1. The Contractor shall furnish all labor, materials, equipment and incidentals required to provide painting as shown and specified. The work includes the coating and finishing of all interior and exterior items and surfaces throughout the project except as otherwise shown or specified. Surface preparation, priming and coatings may be in addition to shop priming and surface treatment specified under other Sections.
2. Where items are factory-coated, repair or touch-up the factory coating and/or apply additional field coatings to achieve a complete coating system complying with the type and thickness of the coatings specified in this Section.
3. The term "coating" as used herein means all coating systems materials, which includes but is not necessarily limited to pretreatments, primers, intermediate coats, finish coats, emulsions, enamels, varnishes, stains, sealers, fillers, and other applied materials whether used as prime, intermediate or finish coats.
4. The term "exposed" as used herein means all items not covered with concrete, plaster, fireproofing or similar material.
5. Where items or surfaces are not specifically mentioned, coat these items or surfaces the same as adjacent similar materials or surfaces.
6. "Typical Examples" of items to be coated are provided on each coating system description sheet. These examples are intended to show the general scope of items to be coated are not intended to be exhaustive of all items to be coated by that particular coating.
7. Items which must be coated under this section include but are not necessarily limited to the following:
 - a. Piping
 - b. Pipe supports
 - c. All other surfaces not otherwise excluded herein.

B. Coordination

1. Review installation procedures under other Sections and coordinate the installation of items that must be field coated or painted.
2. Coordinate the coating of areas to be coated that will be inaccessible once equipment has been installed.
3. Provide finish coats that are compatible with the primers used. Contractor shall be responsible for the compatibility of all shop primed and field coated items in this Contract. Barrier coats shall be provided over incompatible primers or primers shall be removed and re-primed as required.

- C. Pre-Finished Items: Unless otherwise shown or specified, coating shall not be included when factory finishing such as baked-on enamel, porcelain, polyvinylidene fluoride, fusion bonded epoxy, or other similar finish is specified for such items.

1. Touch up factory-finished items only with coatings supplied by the item manufacturer per the requirements and instructions of the manufacturer.
 2. If a factory-finished coating is applied to an item, which is not specified to receive a factory finish coat, acceptance of the factory finish coat shall be at the discretion of the Engineer. The color shall be noted with the equipment submittals.
- D. Items Not to be coated: The following items are excluded from coating unless otherwise specified or show:
1. Moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sensing devices, motor and fan shafts unless otherwise specified.
 2. Code-required labels, such as UL and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.
 3. Stainless steel.
 4. Copper.
 5. Aluminum.
 6. Fiberglass.
 7. Instrumentation and galvanized instrument supports
 8. Exterior or interior concrete unless specified or shown on drawings.
 9. Exterior concrete unit masonry unless specified or shown on drawings.
 10. Interior concrete unit masonry unless specified or shown on drawings.

1.02 References

- A. Reference Standards: Applicable provisions and recommendations of the following shall be complied with, except where otherwise shown or specified:

<u>Reference</u>	<u>Title</u>
ANSI A13.1	Scheme for the Identification of Piping Systems
Ten States Standards	Great Lakes - Upper Mississippi River Board of State Sanitary Engineers, Recommended Standards for Waste Treatment Works - Latest Edition, Recommended Color Scheme for Piping
OSHA 1910.144	Safety Color Code for Marking Physical Hazards
SSPC Volume 2	Systems and Specification, Surface Preparation Guide and Paint Application Specifications

1.03 Submittals

- A. Shop Drawings: The following shall be submitted for approval:
1. Manufacturer's technical information, including coating label analysis and application instructions for each material proposed for use. Each material shall be listed and cross-referenced to the specific coating system and application, and shall be identified by manufacturer's catalog number and general classification.
 2. Provide itemized schedule of all the surfaces to be coated. After approval of submittals and prior to beginning work, Owner's Representative will note on the schedule the colors to be furnished.
 3. Manufacturer's complete color charts for each coating system.

4. Certifications from manufacturers shall be provided, verifying that the factory applied prime coats are compatible with specified finish coatings.

1.04 Delivery, Storage, and Handling

- A. Delivery of Materials: All materials shall be delivered to the job site in original, new and unopened packages and containers bearing manufacturer's name and label, and the following information.
 1. Name or title of material
 2. Manufacturer's stock number and date of manufacture
 3. Manufacturer's name
 4. Contents by volume, for major pigment and vehicle constituents
 5. Thinning instructions where recommended
 6. Application instructions
 7. Color name and number
- B. Storage of Materials
 1. Only acceptable project materials shall be stored on project site.
 2. Store materials in compliance with manufacturer's requirements in a location approved by the Owner's Representative. Area shall be kept clean and accessible.
 3. Storage shall be restricted to coating materials and related equipment only.

PART 2 - PRODUCTS

2.01 Manufacturers:

- A. Products manufactured by one of the following shall be provided:
 1. Tnemec Company, Incorporated
 2. International Coatings
- B. Substitutions
 1. No substitutions shall be considered that decrease the film thickness, the number of coats, the surface preparation or the generic type of coating specified. Approved manufacturers must furnish the same color selection as the manufacturers specified, including accent color in all coating systems.

2.02 Materials

- A. Only the best grade of the various types of coating suitable for use in water and wastewater treatment plants, as regularly manufactured by acceptable coating material manufacturers, shall be provided. Material not displaying the manufacturer's identification as a best-grade product will not be acceptable.
- B. Primers shall be produced by the same manufacturer as the intermediate and finish coats. Use only thinners recommended by the manufacturer, and use only to recommended limits.
- C. Coatings and pipe markers of durable and washable quality shall be provided. Materials that will withstand normal washing as required to remove grease, oil, chemicals, etc., without showing discoloration, loss of gloss, staining, or other damage shall be used.

2.03 Colors and Finishes

- A. Surface treatments, and finishes, are shown under Coating Systems below. All substrates indicated shall be coated whether or not shown on the Drawings, or in Schedules, unless an item is specifically scheduled as not requiring coating.
- B. Color Selection
 - 1. The Owner reserves the right to select non-standard colors for all coating systems specified within the ability of the manufacturer to produce such non-standard colors. Selection of non-standard colors shall not be cause for the Contractor rejecting Owner's color selections and the Contractor shall supply such colors at no additional expense to the Owner.
- C. Piping Color Code:
 - 1. To be selected by the Owner.
- D. Color Pigments: Pure, non-fading, applicable types to suit the substrates and service indicated.

2.04 Coating Systems

- A. Refer to the following Coating System Sheets.
- B. The Contractor shall coat all items, which fall into the categories described. The examples given on the coating system sheets are presented for the Contractor's convenience, and may not include all items which require coating. In general all exposed ferrous materials shall be coated. This includes galvanized materials and shop primed material unless specifically excluded elsewhere.

Coating System 1

A. Service:

1. Structural steel, miscellaneous metals, and steel, ductile iron, or cast iron piping
2. Interior exposure
3. Non-submerged applications (greater than 3' above highest possible water level).

B. Typical Examples:

1. All exposed structural steel including but not limited to columns, beams, roof joists, purlins and other supporting members.
2. Equipment including but not limited to pumps, blowers, air compressors, valves, and other process equipment, motors, gear reducers, and equipment guards.
3. Steel, ductile, or cast iron piping not otherwise coated as specified in piping sections.

C. Surface Preparation:

1. Shop: SSPC-SP 6 Commercial Blast, as specified in herein.
2. Field: Sandblasting of field welds and other imperfections. Owner's Representative may require all areas to be blasted at his discretion, SSPC-SP 6, commercial blast as specified in herein.

D. Product and Manufacturer: One of the following shall be provided:

1. Tnemec
 - a. Primer: Series V69 Hi-Build Epoxoline II - one or more coats, 3.0 - 5.0 total dry mils thickness
 - b. Finish: Series 435 Perma Glaze - one or more coats, 15.0 - 20.0 total dry mils thickness
2. Or equal

Coating System 2

A. Service:

1. Structural steel, miscellaneous metals, and steel, ductile iron, or cast iron piping
2. Exterior exposure
3. Non-submerged applications (greater than 3' above highest possible water level)

B. Typical Examples:

1. All exposed structural steel including but not limited to columns, beams, roof joists, purlins and other supporting members.
2. Equipment including but not limited to pumps, blowers, air compressors, valves, other process equipment, motors, gear reducers, and equipment guards.
3. Overhead coiling and man doors if not specified door elsewhere.
4. Steel, ductile, or cast iron piping not otherwise coated as specified in piping sections.

C. Shop Surface Preparation:

1. Shop: SSPC-SP 6 Commercial Blast as specified in herein
2. Field: Sandblasting of field welds and other imperfections. Owner's Representative may require all areas to be blasted at his discretion, SSPC-SP 6, commercial blast as specified in herein.

D. Products and Manufacturer: One of the following shall be provided:

1. Thnemec
 - a. Primer: Series V69 Hi-Build Epoxoline II - one or more coats, 3.0 - 5.0 total dry mil thickness
 - b. Intermediate: Series V69 Hi-Build Epoxoline II - one or more coats, 3.0 - 5.0 total dry mil thickness
 - c. Finish: Series 1075 Endura-Shield - one or more coats, 3.0 - 5.0 total dry mil thickness
2. Or equal

Coating System 3

A. Service:

1. Galvanized structural steel, galvanized miscellaneous metals, and galvanized steel pipe.
2. Interior exposure
3. Non-submerged applications (greater than 3' above highest possible water level)

B. Typical Examples:

1. All exposed galvanized structural steel including but not limited to columns, beams, roof joists, purlins and other supporting members.
2. Flashing.
3. Galvanized rigid conduit.

C. Surface Preparation:

1. Solvent Cleaning, SSPC-SP 1 as specified in herein, followed by brush off blast to provide an anchor profile of 1.5 to 2.0 mils minimum

D. Product and Manufacturer: One of the following shall be provided:

1. Tnemec
 - a. Primer: Series V69 Hi-Build Epoxoline II - one or more coats, 3.0 - 5.0 total dry mil thickness
 - b. Finish: Series V69 Hi-Build Epoxoline II - one or more coats, 3.0 - 5.0 dry total dry mil thickness
2. Or equal

Coating System 4

A. Service:

1. Galvanized structural steel, galvanized miscellaneous metals, and galvanized steel pipe.
2. Aluminum tube
3. Exterior exposure
4. Non-submerged applications (greater than 3' above highest possible water level)

B. Typical Examples:

1. All exposed galvanized structural steel including but not limited to columns, beams, roof joists, purlins and other supporting members.
2. Flashing
3. Galvanized rigid conduit
4. Bollards
5. All buried and exposed aluminum tubing in contact with dissimilar materials including but not limited to other metals, concrete, wastewater, and soil.

C. Surface Preparation:

1. Solvent Cleaning, SSPC-SP 1 as specified in herein, followed by brush off blast to provide an anchor profile of 1.5 to 2.0 mils minimum

D. Product and Manufacturer: One of the following shall be provided:

1. Tnemec
 - a. Primer: Series V69 Hi-Build Epoxoline II -- one or more coats, 3.0 - 5.0 total dry mil thickness
 - b. Intermediate: Series V69 Hi-Build Epoxoline II -- one or more coats, 3.0 - 5.0 total dry mil thickness
 - c. Finish: Series 1075 Endura-Shield -- one or more coats, 3.0 - 5.0 total dry mil thickness
2. Or equal

Coating System 5

A. Service:

1. Structural steel, miscellaneous metals and steel, ductile iron, or cast iron piping
2. Submerged, intermittently submerged, or splash zone applications (within 3' of highest possible water level).

B. Typical Examples:

1. Structural steel
2. Steel, ductile, or cast iron piping not otherwise coated as specified in piping sections.
3. Pump base elbows, pumps, mixers and other process equipment
4. Pipe supports

C. Surface Preparation:

1. Shop: SSPC-SP 10 Near-White Blast Cleaning
2. Field: Sandblasting of field welds and other imperfections. Owner's Representative may require all areas to be blasted at his discretion, SSPC-SP 6, commercial blast as specified in herein.

D. Product and Manufacturer: One of the following shall be provided:

1. All systems described in Paragraph B except pumps
 - a. Tnemec
 - 1) Primer: Series V69 Hi-Build Epoxoline II - one or more coats, 3.0 - 5.0 total dry mil thickness
 - 2) Intermediate: Series V69 Hi-Build Epoxoline II - one or more coats, 3.0 - 5.0 total dry mil thickness
 - 3) Finish: Series V69 Hi-Build Epoxoline II - one or more coats, 3.0 - 5.0 total dry mil thickness
 - b. Or equal
2. Pumps
 - a. Tnemec
 - 1) Primer: Series V69 Hi-Build Epoxoline II - one or more coats, 3.0 - 5.0 total dry mil thickness
 - 2) Finish: Series V69 Hi-Build Epoxoline II - one or more coats, 3.0 - 5.0 total dry mil thickness
 - b. Or equal

Coating System 6

A. Service:

1. Galvanized structural steel, galvanized miscellaneous metals, and galvanized steel pipe.
2. Submerged, intermittently submerged, or splash zone applications (within 3' of highest possible water level).

B. Typical Examples:

1. Structural steel
2. Steel piping not otherwise coated as specified in piping sections.
3. Pump base elbows, pumps, mixers and other process equipment
4. Pipe supports

C. Surface Preparation:

1. Solvent Cleaning, SSPC-SP 1 as specified in herein, followed by brush off blast to provide an anchor profile of 1.5 to 2.0 mils minimum

D. Product and Manufacturer: One of the following shall be provided:

1. All systems described in Paragraph B
 - a. Tnemec
 - 1) Primer: Series V69 Hi-Build Epoxoline II -- one or more coats, 3.0 - 5.0 total dry mil thickness
 - 2) Intermediate: Series V69 Hi-Build Epoxoline II -- one or more coats, 3.0 - 5.0 total dry mil thickness
 - 3) Finish: Series V69 Hi-Build Epoxoline II -- one or more coats, 3.0 - 5.0 total dry mil thickness
 - b. Or equal

Coating System 7

A. Service:

1. Plastics including PVC and CPVC Piping
2. Interior or exterior exposure
3. Non-submerged applications

B. Typical Example:

1. Exposed PVC and CPVC piping.
2. Notable Exceptions:
 - a. Do not coat submerged or partially submerged plastic piping.
 - b. Do not coat plastic valves, unions, valve handles or other similar plastic items.
 - c. Do not coat exposed PVC conduit or exposed rigid steel with PVC coating conduit.

C. Surface Preparation:

1. Plastic shall be prepared in accordance with SSPC SP-1 (Solvent Cleaning) followed by SSPC-SP 2 (Hand Tool cleaning). Contractor shall use a solvent compatible with the specified coating and roughen surfaces by sanding.

D. Product and Manufacturer: One of the following shall be provided:

1. Carboline
 - a. Finish: Carbothane 134VOC – two coats, 5.0 total dry mil thickness
2. Tnemec
 - a. Finish: Tnemec Series 1075 – two coats, 5.0 total dry mil thickness
3. International
 - a. Finish: ICI Devoe Devthane 378H - two coats, 5.0 total dry mil thickness
4. Or equal

Coating System 8

A. Service:

1. Concrete

B. Typical Example:

1. Manhole interior.
2. Wetwell interior walls and ceiling.
3. Emergency storage tank interior walls and ceiling.

C. Surface Preparation:

1. Prepare all surfaces to receive coating per manufacturer's recommendations.

D. Product and Manufacturer

1. Sauereisen 210S -- one coat, 60 mils total dry mil thickness. Apply per manufacturer's recommendations.
2. HYDRO-POX 204 UHB (Con-Tech of California, Inc.) – one or more coats, 90 total dry mil thickness. Prepare concrete surfaces with HYDRO-POX 251 penetrating primer.
3. Tnemec Series Perma-Shield FR – one or more coats, 90 total dry mil thickness. Prepare concrete surfaces with Tnemec Series 201 primer.
4. Tnemec Series 120
 - a. Primer: Tnemec Series 120-5002 – one coat, 12 – 18 total dry mil thickness
 - b. Finish: Tnemec Series 120-5001 – one coat, 12 – 18 total dry mil thickness
5. T-lock or DuraPlate 100 PVC liner
 - a. Line all interior exposed surfaces.
 - b. Repair cuts or penetrations of liner per manufacturer's recommendations.
6. Or equal

PART 3 - EXECUTION

3.01 Examination

- A. The Contractor and his applicator shall examine the areas and conditions under which painting work is to be performed and notify the Owner's Representative in writing of conditions detrimental to the proper and timely completion of the Work. The Contractor shall not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Owner's Representative.
- B. The Contractor shall not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to the formation of a durable paint film.

3.02 Preparation

A. Coordination:

- 1. The Contractor shall review installation procedures under other Sections and coordinate the installation of items that must be field painted in this Section.
- 2. The Contractor shall coordinate the painting of areas to be painted that will be inaccessible once equipment has been installed.
- 3. The Contractor shall provide finish coats that are compatible with the prime paints used.
- 4. The Contractor shall review other Sections of these Specifications in which prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates.
- 5. The Contractor shall be responsible for the compatibility of all shop primed and field painted items in this Contract.
- 6. The Contractor shall furnish information on the characteristics of the finish materials proposed to use, to ensure that compatible prime coats are used. Barrier coats shall be provided over incompatible primers or primers shall be removed and re-primed as required.

B. Protection:

- 1. Finished Work of other trades and surfaces not being painted concurrently or not to be painted shall be covered or otherwise protected.
- 2. Work of other trades shall be protected, whether to be painted or not, against damage by the painting and finishing work. All such work shall be left undamaged. All damage shall be corrected by cleaning, repairing or replacing, and repainting, as acceptable to the Owner's Representative.
- 3. Wet Paint signs shall be provided as required to protect newly painted finishes. All temporary protective wrapping provided for protection of this Contract shall be removed after completion of painting operations.

C. Surface Preparation

1. General:

- a. All preparation and cleaning procedures shall be performed as specified herein and in strict accordance with the paint manufacturer's instructions for each particular substrate and atmospheric condition.
- b. All hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish painted shall be removed or provided surface applied protection prior to surface preparation and painting operations. The Contractor

shall remove, if necessary, for the complete painting of the items and adjacent surfaces. Following completion of painting of each space or area, the removed items shall be reinstalled by workmen skilled in the trades involved.

- c. Surfaces to be painted shall be cleaned before applying paint or surface treatments. Oil and grease shall be removed with clean cloths and cleaning solvents prior to mechanical cleaning. The cleaning and painting shall be programmed so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
- d. All surfaces that were not shop painted or that were improperly shop painted, and all abraded or rusted shop painted surfaces, which are to be painted, as determined by the Owner's Representative, shall be prepared as specified below.

2. Concrete and Masonry Surfaces:

- a. Surfaces of concrete, precast concrete, and concrete block to be painted and sealed with clear finish shall be prepared by removing all efflorescence, chalk, dust, dirt, grease and oils with soap and water.
- b. The alkalinity and moisture content of the surfaces to be painted shall be determined by performing appropriate tests. If the surfaces are found to be sufficiently alkaline to cause blistering and burning of the finish paint, this condition shall be corrected before application of paint. The Owner's Representative shall be provided with suitable testing materials to carry out alkalinity and moisture tests.
- c. The Contractor shall not paint over surfaces where the moisture content exceeds 8 percent, unless otherwise permitted in the manufacturer's printed directions.
- d. Concrete and concrete block surfaces that cannot be adequately cleaned by soap and water shall be acid etched. Exceedingly dense concrete may require a second etching.
- e. Brush blast clean shall be equivalent to SSPC-SP 7, to open bug holes and remove all non-adhering concrete. All areas so prepared shall be thoroughly cleaned before beginning coating work.

3. Ferrous Metals:

- a. Non-submerged ferrous surfaces, including structural steel and miscellaneous metal to be shop primed, shall be cleaned of all oil, grease, dirt, mill scale and other foreign matter by commercial blast cleaning complying with SSPC-SP 6.
- b. Submerged ferrous surfaces, including structural steel and miscellaneous metal to be shop primed, shall be cleaned of all oil, grease, dirt, mill scale and other foreign matter by near-white blasting complying with SSPC-SP 10.
- c. Non-submerged, ferrous surfaces that have not been shop-coated shall be cleaned of all oil, grease, dirt, loose mill scale and other foreign substances by commercial blasting, complying with SSPC-SP 6.
- d. Submerged ferrous surfaces that have not been shop-coated or that, in the opinion of the Owner's Representative, have been improperly shop-coated, shall be cleaned of all oil, grease, dirt, mill scale and other foreign matter by near-white blasting complying with SSPC-SP 10.
- e. Bare and blasted or pickled clean metal shall be treated with metal treatment wash coat, prior to priming only if recommended by the paint manufacturer.
- f. Shop applied prime coats that have damaged or bare areas shall be touched-up with primer recommended by the coating manufacturer after commercial blasting complying with SSPC-SP 6.

- g. Weld Preparation: Remove weld spatter and slag by chipping or grinding. Grind all sharp edges and corners to a smooth contour. Welds to be ground free from undercuts, recesses and pinholes.

4. Non-Ferrous Metal Surfaces:

- a. Non-ferrous metal surfaces shall be cleaned in accordance with the coating system manufacturers instructions for the type of service, metal substrate, and application required.

5. Galvanized Surfaces:

- a. The Contractor shall clean free of oil and surface contaminants with solvent or other methods recommended by the coating manufacturer, complying with SSPC-SP 1.
- b. All coated galvanized ferrous metal, interior and exterior, shall be cleaned of all oil, grease, dirt, mill scale and other foreign matter by a brush-off blast cleaning complying with SSPC-SP 7 with 1.5 to 2.0 mils profile.

D. Materials Preparation

1. General:

- a. Painting materials shall be mixed and prepared in strict accordance with the manufacturer's directions.
- b. Coating materials produced by different manufacturers shall not be mixed, unless otherwise permitted by the manufacturer's instructions.
- c. Materials not in actual use shall be stored in tightly covered containers. Containers used in storage, mixing, and application of paint shall be maintained in a clean condition, free of foreign materials and residue.
- d. All materials shall be stirred before application to produce a mixture of uniform density, and as required during the application of the materials. Any film that may form on the surface shall not be stirred into the material. The film shall be removed and, if necessary, the material shall be strained before using.
- e. Brush stripe edges and corners to achieve specified coating thickness and coverage.

2. Tinting:

- a. Each undercoat shall be tinted a lighter shade to facilitate identification of each coat where multiple coats of the same material are to be applied. Undercoats shall be tinted to match the color of the finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat. A code number shall be provided to identify material tinted by the manufacturer.

3. Mixing:

- a. The Contractor shall mix only in mixing pails placed in a suitably sized non-ferrous or oxide resistant metal pans to protect concrete floor from splashes or spills which could stain exposed concrete or react with subsequent finish floor material.
- b. Paint shall be mixed and applied only in containers bearing accurate product name of material being mixed or applied.

3.03 Application

A. General:

- 1. Paint shall be applied by mechanical application techniques such as roller, brush, trowel, air spray, or airless spray in accordance with the manufacturer's directions and recommendations

of Paint Application Specifications No. 1 in SSPC Vol. 2, where applicable, or as required in these Specifications. Brushes best suited for the type of material being applied shall be used. Where approved by the Owner's Representative, rollers of carpet, velvet back, or high pile sheep's wool shall be used, as recommended by the paint manufacturer for material and texture required.

2. The number of coats and paint film thickness required is the same regardless of the application method. Succeeding coats shall not be applied until the previous coat has completely dried.
3. Where multiple coats of the same material is used, tint prime and intermediate coats in order to distinguish each coat.
4. Additional coats shall be applied when undercoats, stains, or other conditions show through the final coat of paint, until the paint film is of uniform finish, color and appearance. This is of particular importance regarding intense primary accent colors. The Contractor shall insure that all surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a film thickness equivalent to that of flat surfaces.
5. Surfaces not exposed to view do not require color coding but require the same coating systems specified for exposed surfaces. Exposed to view surfaces are defined as those areas visible when permanent or built-in fixture, convector covers, covers for finned tube radiation, grilles, etc., are in place in areas scheduled to be painted.
6. The backs of access panels and removable or hinged covers shall be painted to match the exposed surfaces.
7. Aluminum parts in contact with dissimilar materials shall be painted as specified with appropriate finish.
8. Brush stripe welds; bolts; nuts; edges and corners to achieve proper coating thicknesses.

B. Electrical Work:

1. Electrical items to be painted include, but are not limited to, the following:
 - a. Conduit and fittings.
 - b. Miscellaneous panels, junction boxes, motors and accessories.

C. Minimum / Maximum Coating Thickness:

1. The Contractor shall apply each material at not less than the manufacturer's recommended spreading rate, and provide total dry film thickness as specified. Extra coat shall be applied if required to obtain specified total dry film thickness or uniform opacity. If the recommended maximum coating thickness is exceeded, the excess amount will be removed and repaired as specified.

D. System Coating Thickness:

1. The system total dry mil thickness shall be the sum of the Primer, Intermediate and Finish Coats specified.

E. Scheduling Painting:

1. The first-coat material shall be applied to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration. Abrasive blasted ferrous metal surfaces shall be coated within eight (8) hours on the same day of abrasive blasting.
2. Subsequent coats shall be applied as per manufacturer's written recoat parameters as detailed on their product data sheet. Sufficient time between successive coating shall be

allowed to permit proper drying. The Contractor shall not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and the application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

F. Prime Coats:

1. Primed and sealed walls and ceilings shall be recoated where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn-through or other defects caused by insufficient sealing.

G. Pigmented (Opaque) Finish:

1. The Contractor shall completely cover to provide an opaque, smooth surface of uniform finish, color, appearance, and coverage.

H. Brush Application:

1. All brush coats shall be brushed-out and worked onto the surfaces in an even film. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections will not be acceptable. All glass and color break lines shall be neatly drawn.

I. Mechanical Applicators:

1. Mechanical methods shall be used for paint application as suggested by the paint manufacturer. Conduct spray coating under controlled conditions. Protect adjacent structure for overspray.
2. For spray application, apply coating to thickness not greater than suggested in paint manufacturer's instruction.
3. Wherever spray application is used, each coat shall be applied to provide the equivalent hiding of brush-applied coats. Do not double back with spray equipment for the purpose of building up film thickness of 2 coats in one pass.

3.04 Field Quality Control

A. The right is reserved by the Owner's Representative to invoke the following material testing procedure at any time, and any number of times during the period of field painting:

1. Engage the service of an independent testing laboratory to sample any of the paint being used. Samples of materials delivered to the project site will be taken, identified and sealed, and certified in the presence of the Contractor.
2. The testing laboratory will perform appropriate tests for any or all of the following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative material analysis.
3. If the test results show that the material being used does not comply with the specified requirements, the Contractor may be directed to stop the painting Work, and remove the non-complying paint; pay for testing; repaint surfaces coated with the rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with the specified paint, the two coatings are non-compatible.

B. Prior to initial coat and after completion of each successive coat of paint, the Contractor shall notify the Owner's Representative. After inspection, checking of film thickness and approval by the Owner's Representative, proceed with the succeeding coat. Contractor shall supply the Owner's Representative for his use a Gardner dry-film thickness gage.

3.05 Cleaning

- A. During the progress of the Work, all discarded paint materials, rubbish, cans and rags shall be removed from the site at the end of each work day.
- B. Upon completion of painting work, all paint-spattered surfaces shall be cleaned. Spattered paint shall be removed by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.
- C. At the completion of work of other trades, all damaged or defaced painted surfaces shall be touched-up and restored, as determined by the Owner's Representative.

3.06 Demonstration

- A. Completed Work:
 - 1. The Contractor shall match approved samples for color, texture and coverage.
 - 2. Work not in compliance with specified requirements shall be removed, refinished or repainted, as required by the Owner's Representative.

**** END OF SECTION ****

SECTION 13220 PRESSURE REDUCING STATION

PART 1 – GENERAL

1.01 SUMMARY

- A. This section describes the requirement for furnishing and installing a pressure reducing station as shown on the plans, and all pertaining piping and appurtenances. These requirements include the types of materials to be used, methods and requirements for installation, and measurement for payment.
- B. Work under this section includes, but not limited to, excavation (regardless of surface and subsurface conditions), controlling water and dust, furnishing and installing the vaults and accessories, pipe and fittings, thrust restraint assemblies, valves, automatic control valves, remote sensing line, and restoring the surface area around the vault and accessories.

1.02 LOCATION

- A. The pressure reducing stations shall be installed at the locations shown on the plans. Field staking the location shall be requested prior to start of construction on these facilities.

1.03 SUBMITTALS

- A. Submittals supplied by the Contractor shall include:
 - 1. Annotated product bulletins for the PRV including design calculations
 - 2. Plans or shop drawings for the enclosure
 - 3. Shop drawings of automatic control valves
 - 4. Operating and maintenance manual for the automatic control valves
 - 5. Enclosure: Manufacturer's specifications and color chips for the paint coating.

1.04 DELIVERY, STORAGE AND HANDLING

- A. All valves and miscellaneous items shall be packed, shipped, stored and handled in accordance with manufacturer recommendations.

PART 2 – PRODUCTS

2.01 GENERAL

- A. Materials furnished for the pressure reducing station shall include, but not be limited to: the enclosures and accessories including doors; pipe and fittings; thrust restraint assembly and concrete; valves, automatic control valves and accessories, floor stands and saddles, flex couplings, pressure gauges, remote sensing line, fittings, and paint. Installation requirements for these items are also included.

2.02 ENCLOSURE

- A. See Enclosure Notes on drawings

2.03 PIPE AND FITTINGS

A. See Specification Section 15060 – Piping Systems

2.04 VALVES

A. See Specification Section 15100 – Valves and Misc Components

2.05 AUTOMATIC CONTROL VALVES

- A. Manufacturer: All automatic control valves shall be as manufactured by the Cla-Val Co. or equal
- B. Model: The valves shall be Class 125 with end configurations as shown on the plans.
1. The 2-IN pressure-reducing valve shall be model number 90-01 ABCS.
 2. The 4-IN and 6-IN pressure-reducing valves shall be model number 690-01 ABCS (remote sensing).
 3. The valves shall be supplied with shutoff cocks and screens on all pilot lines, opening and closing speed controls, valve stem position indicators, and pilot controls with a 30 to 300 psi pressure range, unless the pressure shown on the plans is outside this range, then supply pilot controls with the lowest range to fit the pressure. The pressure reducing valves shall also be furnished with CV2 Flow Stabilizers.
 4. The 4-IN and 6-IN pressure-reducing valve shall be furnished with a remote sensing pilot.
- C. Materials:

Components

Body & Cover

Disc Retainer & Diaphragm Washer

Trim: Disc Guide, Seat & Cover Bearing

Disc

Diaphragm

Stem, Nut & Spring

Lining and Coating

Material

Ductile Iron

Cast Iron

Stainless Steel

Buna-N Rubber

Nylon Reinforced Buna-N Rubber

Stainless Steel

Fusion Epoxy

- D. City forces shall adjust and test the automatic control valves and place them into operation. The Contractor shall provide any assistance necessary to place valves into operation, including a manufacturer's technician, if required.
- F. Provide startup services for the pressure reducing valves; coordinate startup operation with City and Engineer.

2.06 PRESSURE GAUGES

A. See Specification Section 15100 – Valves and Misc Components

2.07 REMOTE SENSING LINE AND FITTINGS

- A. The remote sensing line and fittings, and their installation, shall conform in all respects to service lines and fittings and installation, as described elsewhere in these specifications.

PART 3 – COATINGS

3.01 PAINT

- A. All interior piping, other than ductile iron pipe, and appurtenances of the pressure reducing station, including floor stands, shall be painted after performing a leak test. The paint shall be a two-coat epoxy polyamide system consisting of a prime coat and finish coat. The paint shall be Epoxoline, as manufactured by Tnemec, Koppers Ponkote 300, Engard 445, or approved equal. The color shall be similar to Tnemec Aqua Sky, Koppers or Engard Aqua Green. Color chips shall be submitted for approval prior to purchase of the paint.
- B. The automatic control valve and their pilot systems shall be masked and not painted. All brass pipe, fittings, valves, cocks, and hose bibs shall be masked and not painted. All other metallic pipe and accessories, including the floor stands, shall be prepared and painted. Surface preparation and paint application shall be in accordance with manufacturer's recommendation. All items not to receive paint shall be protected from grinding and sandblasting operations. All areas of the vault and lid shall be protected from paint drips or overspray. Adequate ventilation shall be provided to insure proper curing of the paint system.

PART 4 – FINAL CLEANUP

4.01 AREA OF WORK

- A. All areas disturbed by Contractor's activities relating to the construction of the pressure reducing station and accessories, including the water mains delivering water to and from the stations, shall be promptly restored to a reasonable and presentable manner as close to the pre-existing conditions as reasonably possible.

****END OF SECTION****

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SECTION 15000 PIPING MATERIALS AND COMPONENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. This section specifies the general requirements for piping materials and components and their installation and testing, and shall be used in conjunction with the Section 15060 – Piping Systems and the Contract Drawings.

1.02 REFERENCES

- A. This section references the following documents. They are a part of this section insofar as specified and modified herein. In case of conflict between the requirements of this section and the listed documents, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
ANSI A13.1	Scheme for the Identification of Piping Systems
AWWA C651	Disinfecting Water Mains
MTL-STD-810C	Military Standard Environmental Test Methods

1.03 DIAGRAMMED PIPELINES

- A. Various pipelines are shown on the drawings in diagram form. These diagrammed pipelines shall be furnished, fabricated, erected and otherwise installed to lines, elevations, locations and dimensions as shown, specified or required for a complete installation. The Contractor shall verify all dimensions shown on the Plans and shall take such field dimensions as may be necessary to properly install all diagrammed pipelines.
- B. The cost of furnishing, fabricating, locating, erecting and otherwise completely and properly installing all diagrammed pipelines shall be included in the lump sum Contract bid price and no separate payment will be made thereof.

PART 2 - PRODUCTS

2.01 PIPING

A. Material

1. Unless otherwise specified, piping materials, including pipe, gaskets, fittings, connection and joint assemblies, lining and coating, shall be selected from those listed on the Section 15060 - Piping Systems. Piping materials shall conform to detailed specifications for each type of pipe and piping appurtenance specified in Division 15.

B. Flange Assemblies

1. Flat faced flanges shall not be bolted to raised face flanges.
2. Gaskets for flat faced flanges shall be the full face type.
3. Gaskets for raised faced flanges shall match the raised face type.
4. Utilize only flat faced flanges when using flanges to mate dissimilar piping materials.

2.02 PIPE IDENTIFICATION

A. Plastic Coding Markers

1. Plastic markers for coding pipe shall conform to ANSI A13.1 as manufactured by Brady, Seton, or equal.
2. Markers shall be the mechanically-attached type that are easily removable; they shall not be the adhesive applied type.
 - a. Markers shall consist of pressure sensitive legends applied to plastic backing that is strapped or otherwise mechanically attached to the pipe.
 - b. Legend and backing shall be resistant to petroleum based oils and grease and shall meet the criteria for humidity, solar radiation, rain, salt, fog and leakage fungus, as specified by MIL-STD-810C.
 - c. Plastic coding markers shall not be the individual letter type but shall be manufactured and applied in one continuous length of plastic.
3. Markers bearing the legends on background colors selected by the Owner's Representative shall be provided in the heights required by ANSI A13.1.
4. Pipe markers shall include unidirectional and bidirectional arrows required by ANSI A13.1.

B. Tracer Wire

1. Tracer wire shall be #12 insulated solid strand copper wire and included for piping as indicated herein.

C. Warning Tape

1. Tracer tape shall be 12 inches wide and included for piping as indicated herein. Tracer tape shall be made of inert plastic material suitable for direct burial and capable of stretching to twice its original length.
2. Tracer tape shall be blue for potable water, purple for recycled water, and green for all other lines.
3. A warning message shall be printed on the tape.
 - a. For Potable Water the message shall read "CAUTION: BURIED WATER PIPE BELOW."
 - b. For Sewer Line the message shall read "CAUTION: BURIED SEWER PIPE BELOW".
 - c. For all other services the message shall read "CAUTION: BURIED PIPE BELOW". Letters shall be with black and the message shall be printed at maximum intervals of 2 feet.
4. The message shall be printed at maximum intervals of 2 feet.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

1. Only proper implements, tools, and facilities as recommended by the pipe manufacturer's standard printed installation instructions shall be used.
2. The interior of all pipes shall be cleaned of all foreign matter before installing.
3. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.
4. Lay pipe with label facing up.

5. While pipe laying is NOT in progress, the open ends of the installed pipe shall be closed to prevent trench water from entering into the interior of the pipe.
 - a. Adequate backfill shall be deposited on pipe to prevent floating of pipe.
 - b. Any pipe that has floated shall be removed from the trench, cleaned, and re-laid in an acceptable manner.
 - c. The use of burlap, wood, or other similar temporary plugs will not be permitted.
6. Cable, rope, or other devices used for lowering fittings into trench shall be attached around the exterior of fitting for handling. Under no circumstances shall the cable, rope or other device be attached through the fitting's interior for handling.

B. Diagrammed Pipe

1. Where such pipelines are shown only in diagram, they shall be arranged clear of other pipelines, equipment and walking areas, and shall be accessible for maintenance.
 - a. Such pipelines shall be fitted and installed in a neat and workmanlike manner in accordance with approved shop drawings.
 - b. An adequate number of unions shall be provided to facilitate dismantling or removal.
2. The final locations of appurtenances included as part of diagrammed pipelines shall be shown on the approved shop drawings or as determined in the field by the Owner's Representative.

C. Anchorage

1. All bends, plugs, joints, caps and tees in pressure piping systems shall be anchored by means of restrained joints unless otherwise specified or shown.

D. Pipe Flexibility

1. Unless otherwise specified or shown, wherever piping 6 inches in diameter and larger passes from concrete to earth, 2 sleeve type flexible pipe couplings or flexible joints shall be provided with the first joint between 2 feet and 3 feet from the face of the structure.
 - a. The spacing between the two couplings shall be between 2 and 3 feet.
 - b. A single sleeve type flexible pipe coupling can be utilized if the concrete wall penetration employs a flexible pipe seal.
 - c. Where required for resistance to pressure, flexible couplings shall be restrained.

E. Vents and Drains

1. Manual air vents shall be provided at the high points of each reach of pipeline whether shown or not shown on drawings.
 - a. Manual air vents shall consist of a 1/4" bronze cock and short copper tubing return.
 - b. Copper tubing shall be routed to the nearest floor.
 - c. Manual air vents in piping systems for fluids containing solids shall be 1-inch non-lubricated eccentric plug valves fitted with quick couplers.
2. Whether shown or not shown on drawings all pipelines shall be provided with a tap or welded nipple and valved drain on the bottom of the pipe.
 - a. Drains shall be piped to a sump, gutter, floor drain or other collection point.
 - b. Drain valves shall be 1" gate valves unless shown otherwise.
 - c. When drains cannot be run to collection points, they shall be rerouted to a point of easy access.

F. Pipe Identification

1. Pipe Coding

- a. After application of the specified coating or painting and insulation systems, exposed piping, both interior and exterior, and all piping in ceiling spaces, pipe trenches, pipe chases and valve boxes shall be identified with plastic markers.
- b. Locate pipe markers and color bands wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels and plenums), and exterior nonconcealed locations, in locations as follows:
 - 1) Near each valve and control device.
 - 2) Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
 - 3) Near locations where pipes pass through walls or floors/ceilings, or enter nonaccessible enclosures.
 - 4) At access doors, manholes and similar access points which permit view of concealed piping.
 - 5) Near major equipment items and other points of origination and termination
 - 6) Spaced intermediately at maximum spacing of 20 feet along each piping run, except reduce spacing to 10 feet in congested areas of piping and equipment, i.e., mechanical rooms.

2. Warning Tape and Tracer Wire

- a. Warning tape shall be installed 12 inches above all potable water, recycled water, primary influent and foul air pipes. Tape shall be spread flat with message side up before backfilling.
- b. Tracer wire shall be continuous and attached to all potable water and recycled water pipes. Tracer wire through valve boxes shall be placed outside of riser and inside of valve box.
- c. The final locations of hose valves and other such appurtenances included as part of diagrammed pipelines shall be shown on the approved shop drawings or as determined in the field by the Owner's Representative.

3.02 **CLEANING AND FLUSHING**

A. General:

1. Piping systems shall be flushed and cleaned prior to testing. The Contractor may, in order to facilitate the cleaning of sections of buried or exposed piping between isolating valves, clean and test the system as specified in this section, prior to connection to the valving. Use of this procedure, however, will not waive the requirement for a full test of the completed system.
2. Unless specified otherwise, piping 24 inches in diameter and smaller shall first be cleaned by pulling a tightly fitting cleaning ball or swab through the system.
3. Piping larger than 24 inches in diameter may be cleaned manually or with a cleaning ball or swab.

B. Liquid Systems:

1. After completion of cleaning, piping systems 12" and less shall be flushed with clean water for a minimum period of 15 minutes at the flow rate required to produce a minimum velocity of 6 feet per second.
 - a. Contractor is responsible for all temporary piping and facilities required.

- b. Contractor shall comply with all State and Local regulations and requirements for disposal of flushing water.
2. Potable water piping systems shall be flushed and disinfected in accordance with AWWA C651. Post disinfection testing shall be done and paid for by the Contractor.

3.03 TESTING

A. Upon completion of installation the Contractor shall test each piping system.

1. Pressures, media and test durations shall be as specified in the Section 15060 – Piping Systems.
2. Equipment that may be damaged by the specified test conditions shall be isolated.
3. Each test gauge shall be selected so that the specified test pressure falls within the upper half of the gauge's range.
4. The Contractor shall notify the Owner's Representative prior to each test and shall perform each test in the presence of the Owner's Representative.
5. Pipes shall not be encased in concrete until leakage test is completed and passed.
6. Pipes shall not be covered by concrete slabs or pavement until leakage test is completed and passed.
7. Exposed pipes shall not be insulated until leakage test is completed and passed.
8. Flanges or flex couplings shall not be backfilled or buried until leakage test is completed and passed.

B. Pumped or Pressure Systems:

1. Prior to testing, the pipeline shall be slowly and carefully filled with water. All air shall be expelled slowly from the pipe and appurtenances in a manner so as not to create excessive surge pressures.
2. The pipeline shall be filled with water at least twenty-four hours prior to testing when.
3. Where air valves or other suitable outlets are not available for releasing air before applying the test, approved taps and fittings shall be installed and later securely plugged.
4. The Contractor may, at his own risk, test against existing valves. Suspected leaking of the existing valves will not be accepted as a reason for having not passed the leakage test requirements. These valves shall either be repaired or replaced prior to the start of another testing sequence. All new valves shall be tested against a reduced pressure side. Butterfly valves shall be tested in both directions.
5. The length of pipe being tested at any one time shall not exceed 2,000 feet unless otherwise approved by the City.
6. The pipeline then shall be brought up to 200 psi or 50 psi greater than design pressure of the system, whichever is greater, measured at the lowest point of the section of the pressure zone being tested.
7. The test duration shall be two hours. Pressure in the pipeline shall be maintained within 2 psi of the calculated test pressure for the full two-hour duration. The individual testing of the valves may be of a shorter duration as approved by the City.
8. The allowable leakage per test section shall be calculated from the formula below:
 - a. $W = N \cdot D \cdot (P^{0.5}/7400)$ where

- 1) W= allowable leakage in gal/hr

- 2) N = number of joints in the length of pipeline tested
 - 3) D = normal diameter in inches
 - 4) P = Average test pressure in psi
- 9. During the pressure and leakage test, all accessible appurtenances shall be inspected for visual signs of leakage.
 - 10. All visible leaks shall be corrected immediately, regardless of the amount of leakage and the test shall be run again for its full duration.
 - 11. All leaks detected shall be repaired to a water tight condition.

****END OF SECTION****

SECTION 15060 PIPING SYSTEMS

PART 1 - DESCRIPTION

1.01 General

A. This Section specifies requirements for piping systems consisting of pipe, fittings and valves.

1.02 References

A. This Section references the following documents. They are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

<u>Reference</u>	<u>Title</u>
ANSI B16.3	Malleable-Iron Threaded Fittings
ANSI B16.9	Factory-Made Wrought Steel Butt-Welding Fittings
ASTM A47	Standard Specification for Ferritic Malleable Iron Castings
ASTM A53	Standard Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated, Welded and Seamless
ASTM A234	Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM A312	Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
ASTM A403	Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings
ASTM D1784	Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D1785	Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D2751	Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
ASTM D2466	Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2564	Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

<u>Reference</u>	<u>Title</u>
ASTM F439	Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80
ASTM F441	Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80
ASTM F493	Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings
AWWA C106	Standard for Gray-Iron Pipe Centrifugally Cast in Metal Molds for Water or Other Liquids
AWWA C108	Standard for Cast-Iron Pipe Centrifugally Cast in Sand-Lined Molds for Water or Other Liquids
AWWA C110	Gray-Iron and Ductile Iron Fittings 3 Inch Through 48 Inch for Water and Other Liquids
AWWA C111	Standard for Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
AWWA C151	Standard for Ductile Iron Pipe Centrifugally Cast in Metal Molds or Sand-Lined Molds for Water or Other Liquids
AWWA C200	Steel Water Pipe 6 Inches and Larger
AWWA C205	Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe 4 Inches and Larger - Shop Applied.
AWWA C208	Standard Dimensions for Steel Water Pipe
AWWA C210	Standard for Coal-Tar Epoxy Coating System for the Interior and Exterior of Steel Water Pipe
AWWA C900	Standard for PVC Pressure Pipe
AWWA C905	Standard for Large Diameter PVC Pressure Pipe

1.03 Piping System Specification Sheets (PIPESPEC)

A. Each process piping system is specified in the following PIPESPEC sheets:

PIPING SYSTEM SPECIFICATION SHEET--PIPESPEC

System

WATER (W) - POTABLE

Test Medium: Water
Test Pressure: 200 psi
Test Duration: 120 Minutes with no detectable leakage

Buried Piping 3-inch and less

Pipe: PVC Class 200, iron pipe size outside diameter, conforming to ASTM D241.
Fittings: PVC Class 200, iron pipe size outside diameter, conforming to ASTM D241.
Valves: Gate Valve.

Buried Piping 4-inch through 12-inch diameter

Pipe: PVC AWWA C900, cast iron outside diameter, Class 200, with all restrained joints.
Fittings: AWWA C153 Ductile Iron Fittings, Class 350, with Mechanical Joint or C110 Class 350 Ductile Iron Flanged Fittings, as shown on plan set; all restrained and cement lined and coal tar pitch varnish coated.
Valves: Gate valves – Clow AWWA C509 series with ductile iron with rubber encapsulated wedge and 316 stainless steel bolts.
Restraint: At mechanical joints - Megalug Series 2000PV with Megabond restraint coating system & Tripac fluoropolymer coated tee bolts, be cast from gray or ductile iron, meeting requirements of ANSI/AWWA C110/A.21.10. For bell to bell: Uni-flange series 1350 PVC pipe bell joint restraint. Restraints shall be for use with C900 PVC Pipe, with minimum pressure rating of 200 psi.

Buried Piping 14-inch through 36-inch diameter

Pipe: PVC AWWA C905, cast iron outside diameter, Class 200, with all restrained joints.
Fittings: AWWA C153 Ductile Iron Fittings, Class 350, with Mechanical Joint or C110 Class 350 Ductile Iron Flanged Fittings, as shown on plan set; all restrained and cement-lined and coal tar pitch varnish coated.
Valves: Gate valves – Clow AWWA C509 series with EPDM disc and 316 stainless steel bolts.
Restraint: At mechanical joints - Megalug Series 2000PV with Megabond restraint coating system & Tripac fluoropolymer coated tee bolts, be cast from gray or ductile iron, meeting requirements of ANSI/AWWA C110/A.21.10. For bell to bell: EBAA Series 2500 restraint harness, Uni-Flange Series 1350 PVC pipe bell joint restraint, or approved equal. Restraints shall be for use with C900 PVC Pipe, with minimum pressure rating of 200 psi.

Notes:

1. *Pipe shall be disinfected by Contractor in accordance with the City of Morgan Hill Water Section Standard Details and AWWA Standards C651.*
2. *Piping materials for fittings and valves, including blowoffs and AVRVs shall be per the City of Morgan Hill Water Section Standard Details.*
3. *Refer to the City of Morgan Hill Water Section Standard Details for additional pipeline requirements.*

PART 2 – MATERIALS (NOT USED)

PART 3 – EXECUTION (NOT USED)

**** END OF SECTION****

SECTION 15062 DUCTILE IRON PIPE

PART 1 - GENERAL

1.01 Description

- A. Scope: This section specifies ductile iron pipe, ductile or gray iron fittings and gaskets.
- B. Definition: Where cast iron pipe is specified, the term and symbol shall mean ductile iron pipe.

1.02 References

- A. This section references the following documents. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
ANSI/ASME B1.20.1	Pipe Threads General Purpose
ANSI/ASME B16.1	Cast Iron Pipe Flanges and Flanged Fittings
ANSI/AWWA C104/A21.4	Cement Mortar Lining for Ductile Iron Pipe and Fittings
ANSI/AWWA C105/A21.5	Polyethylene Encasement for Ductile Iron Pipe Systems
ANSI/AWWA C110/A21.10	Ductile Iron and Gray Iron Fittings (3-in through 48-in)
ANSI/AWWA C111/A21.11	Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings
ANSI/AWWA C115/A21.15	Flanged Ductile Iron Pipe with Ductile Iron or Gray Iron Threaded Flanges
ANSI/AWWA C116/A21.16	Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior Surfaces of Ductile Iron and Gray Iron Fittings
ANSI/AWWA C150/A21.50	Thickness Design of Ductile Iron Pipe
ANSI/AWWA C151/A21.51	Ductile Iron Pipe, Centrifugally Cast, for Water (3-in through 64-in)
ANSI/AWWA C153/A21.53	Ductile Iron Compact Fittings for Water Service
ANSI/AWWA C600	Installation of Ductile Iron Water Mains and their Appurtenances
ANSI/AWWA C606	Grooved and Shouldered Joints
ANSI B18.2.1	Square and Hex Bolts and Screws
ASTM A377	Index of Specifications for Ductile Iron Pressure Pipe
ASTM A674	Standard Practice for Polyethylene Encasement for Ductile Iron Piping for Water or Other Liquids

1.03 Submittals

- A. The Contractor shall submit the following in accordance with Section 01300:
1. Shop drawings
 2. Alignment drawings

3. Certification that such length of pipe has been tested physically for ductility and has satisfactorily passed such tests.

PART 2 - PRODUCTS

2.01 General

- A. Pipe design, materials, and manufacture shall comply with the following documents:

Item	Document
Thickness Design	ANSI/AWWA C150/A21.50
Water or Other Liquid	ANSI/AWWA C151/A21.51
Fittings	ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53

2.02 Gaskets

- A. General: Gaskets shall conform to ANSI/AWWA C111/A21.11 and shall have 1/8-inch thickness. Gaskets shall be made of Ethylene Propylene (EPDM) material for drinking water applications.
- B. Mechanical or Push-On Joint Gaskets: Mechanical joint, solid ring type gasket to conform to ANSI/AWWA C111.
- C. Flange Gaskets: Full face type gasket to conform to ANSI/AWWA C111.
- D. Flange Buried Service Gaskets: Ring type gasket to conform to ANSI/AWWA C111.

2.03 Flange Assemblies

- A. Flange bolts shall be low-carbon steel in conformance with AWWA C141. Stainless steel hardware shall be used in submerged and buried applications and as directed by Engineer.

2.04 Joints

- A. Push-on and Mechanical Joints: The plain ends of push-on pipe and mechanical joint pipe shall be marked with paint to show the required depth of penetration for making the joint.
- B. Restrained Joints: Restrained joints shall be designed to prevent separation of the joint by the pipe's internal thrust after installation. The design shall permit disassembling of the joint for repair and maintenance. At mechanical joints, restraints shall be EBAA Megalug Series 2000PV with Megabond restraint coating system & Tripac fluoropolymer coated tee bolts, be cast from gray or ductile iron, meeting requirements of ANSI/AWWA C110/A.21.10. At push-on (bell to bell), restraints shall be EBAA Series 2500 restraint harness, Uni-Flange Series 1350 PVC pipe bell joint restraint, or approved equal.
- C. Sleeve-Type Couplings
1. Sleeve-Type Couplings, 30 inches and Smaller: Unless otherwise specified, couplings shall be ductile iron or fabricated steel construction, fusion bonded epoxy coated. Standard couplings shall be PowerSeal 3501, Victaulic Depend-O-Lok or equal. Flanged coupling adapters shall be restrained type Romac Industries RFCA, Victaulic or equal. Insulated couplings shall be fabricated steel, PowerSeal 3539, Smith-Blair 416, or equal.

2.05 Fittings

- A. Ends shall be flanged, mechanical joint, as specified in the Section 15060–Piping Systems or as shown in the Drawings. Elbows shall be the long radius style.
- B. Service Saddles
 - 1. Bronze double strap service clamp to match City Detail W-1 or as directed by Engineer.

2.06 Polyethylene Encasement

- A. Polyethylene encasement shall be used on all buried ductile iron pipe and fittings. Installation of polyethylene shall be as specified in ANSI/AWWA C105/A21.5, Section 5-4.2.1, DIPRA's "Polyethylene Encasement" brochure, and these specifications. Pipe, fittings, valves and couplings shall be wrapped. Fittings that require concrete backing shall be wrapped prior to placing the concrete.
- B. The polyethylene encasement seams and overlaps shall be wrapped and held in place by means of a 2-inch wide plastic backed adhesive tape. The tape shall be Polyken No. 900 (polyethylene), Scotchwrap No. 50 (polyvinyl), or equal. The tape shall be such that the adhesive shall bond securely to both metal surfaces and polyethylene film.

2.07 Lining

- A. Unless otherwise shown or specified, lining shall be cement mortar lining conforming to ANSI/AWWA C104/A21.4.

2.08 Coating

- A. Buried Service: Coating and mortar lining seal shall be asphaltic coating per ANSI/AWWA C151/A21.51 for pipe and ANSI/AWWA C110/A21.10 for fittings.
- B. All flange assembly hardware shall be coated with bitumastic.

PART 3 - EXECUTION

3.01 General

- A. Piping runs shown on the drawings shall be followed as closely as possible. Proposed deviations shall be submitted in accordance with Section 01300-Submittals.
- B. Pipe shall be installed in accordance with AWWA C600. Cuts on DIP pipe shall be coated with an acceptable bituminous material. Cut ends on lined pipes shall be coated with Manufacturer's Joint Compound in accordance with the manufacturer's recommendations.
- C. Connections to existing structures and manholes shall be made so that the finished work will conform as nearly as practicable to the requirements specified for the new manholes, including necessary concrete work, cutting and shaping. Concrete mortar shaping within any structure and manhole shall be as specified.
- D. The Contractor shall conduct the tests in the presence of the Engineer.

3.02 Insulating Sections

- A. Where a metallic nonferrous pipe or appurtenance is connected to ferrous pipe or appurtenance, an insulating section of rubber or plastic pipe shall be provided. Each insulating section shall have a length of 2 to 4 inches.

3.03 Anchorage

- A. Anchorage shall be provided as specified. Calculations and drawings for proposed alternative anchorage shall be submitted.

3.04 Restrained Joints

- A. Provide restrained joints as indicated or as required to develop full joint restraint to withstand all working and test pressures. Joints encased in concrete below structures need not be restrained type providing Contractor can show that the concrete encasement will provide the necessary restraint for the piping system.

3.05 Acceptance Testing

- A. Hydrostatic pressure tests shall be conducted and acceptability determined in accordance with AWWA C600 as modified by Section 15060–Piping Systems.

****END OF SECTION****

SECTION 15065 PVC PIPE

PART 1 - GENERAL

1.01 SUMMARY

A. This section specifies polyvinylchloride (PVC) for pressurized and non-pressurized systems.

1.02 REFERENCES

A. This section contains references to some or all of the following documents, most recent edition. They are a part of this section as specified and modified. In case of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

<u>Reference</u>	<u>Title</u>
ANSI/AWWA C900	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In., for Water Transmission and Distribution
ANSI/AWWA C905	Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 14 In. Through 48 In., for Water Transmission and Distribution
ASTM D1784	Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
ASTM D1785	Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D2241	Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2464	Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2466	Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2467	Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2564	Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D2774	Standard Practice for Underground Installation of Thermoplastic Pressure Piping
ASTM D2855	Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings
ASTM D3139	Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM F402	Standard Practice for Safe Handling of Solvent Cements, Primers and Cleaners Used for Joining Thermoplastic Pipe and Fittings
ASTM F477	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
AWWA M23	Manual of Water Supply Practices PVC Pipe – Design and Installation

1.03 SUBMITTALS

- A. The following shall be submitted by the Contractor in accordance with the requirements in General Conditions Section 2.5.
1. Alignment/ Layout drawings
 2. Manufacturer's certificates shall be provided with each delivery. This certifies that each pipe section complies with this specification.
 3. Manufacturers' Affidavits of compliance with applicable references
 4. Descriptive literature showing pipe dimensions, joints, couplings and other details for each size of pipe indicated.

1.04 QUALITY ASSURANCE

- A. The pipe, joints and fittings shall be tested in accordance with the requirements of this specification and as specified in the reference standards. The Contractor shall submit the test results to the Owner's Representative.
- B. Additional sampling may be requested of any material for testing by the Owner at the Owner's expense. The additional samples shall be furnished by the Contractor at no additional cost to the Owner.

1.05 DELIVERY, STORAGE AND HANDLING

A. Delivery

1. Pipe shipment should be carefully inspected by the Contractor upon arrival for defects or damage during delivery.
2. The Manufacturer shall mark the nominal pipe diameter, pressure class, manufacturer's name, date of extrusion, ASTM designation and PVC Cell Classification on the pipe.

B. Storage

1. Pipe shall be stored in such a way as to prevent sagging, compression or bending.
2. Pipe shall be protected from direct sunlight by covering with an opaque material while permitting air circulation.
3. Gaskets should be stored in a cool, dark place out of direct sunlight.

C. Handling

1. Handling of the PVC pipe shall be done in accordance with manufacturer's instructions to insure that the pipe is not damaged in any manner during storage, transit, loading, unloading, and installation.
2. Any length of pipe having a gouge, scratch, or other permanent indentation more than ten (10) percent of the wall thickness in depth shall be rejected.
3. Defective, damaged or rejected pipe shall be immediately removed from the working area and replaced by the contractor at no additional cost to the owner.

1.06 WARRANTY

- A. The pipe shall be warranted to be free of defects in material for a period of one year from substantial completion.

PART 2 - PRODUCTS

2.01 MATERIAL

- A. PVC material for pipes and fitting shall complying with Cell Classification 12454-B or better, in accordance with ASTM D1784.
- B. PVC shall be normal impact unless otherwise specified
- C. Pipe Color shall be based on application as follows:
 - 1. Blue: potable water

2.02 PVC PRESSURE PIPE

- A. C900/ C905:
 - 1. Pipe shall meet the requirements of AWWA Standard C900/ C905, Pressure Class 200 psi.
 - 2. Fittings:
 - a. Ductile iron, see Section 15062
 - 1) Flanged or mechanical joint, as specified in Section 15060 – Piping Systems or as shown in the Drawings.
 - 2) Class 350
 - 3. Joints:
 - a. Push-on:
 - 1) ASTM D3139
 - 2) Push-on gaskets: ASTM F477
 - 4. Restraints:
 - a. Mechanical joints: EBAA Megalug Series 2000PV or approved equal.
 - b. Push-on joints: EBAA Series 2500 restraint harness, Uni-Flange Series 1350 PVC pipe bell joint restraint, or approved equal.

PART 3 - EXECUTION

3.01 GENERAL

- A. All installation, jointing, tests for defects and leakage shall be performed in the presence of the Owner's Representative and shall be subject to his approval before acceptance.
- B. All material found to have defects will be rejected and the Contractor shall promptly remove such defective materials from the work site.
- C. Installation shall conform to the requirements of the following standard practices, instructions furnished by the pipe manufacturer, and to the supplementary requirements or modifications specified in this section. Wherever the provisions of this Section and the aforementioned requirements are in conflict, the more stringent provision shall apply.
 - 1. AWWA Manual M23: C900/C905 PVC Pressure Pipe
- D. Unless otherwise specified, paint PVC piping exposed to direct sunlight as specified in Section 09900.

3.02 TRENCHING AND BACKFILL

- A. Trench excavation and backfill shall conform to the requirements of Section 02200 unless otherwise directed by Engineer.
- B. Bedding:
 - 1. There shall be a minimum 6 inches of sand bedding
 - 2. Bedding shall be checked for firmness and uniformity of surface immediately before placing each section of pipe in final position for jointing.
- C. Select backfill shall be sand to 12 inches above the pipe.
- D. Backfill shall be native material or type "C" backfill.

3.03 INSTALLATION

- A. General:
 - 1. Pipe and fittings shall be of the sizes indicated.
 - 2. Proper implements, tools, and facilities as recommended by the pipe manufacturer's standard printed installation instructions shall be provided and used by the Contractor for safe and efficient execution of the Work.
 - 3. The interior of the pipe shall be cleaned of all foreign matter before installing.
 - 4. The pipe and accessories shall be inspected for defects prior to lowering into the trench. Any defective, damaged or unsound pipe shall be repaired or replaced.
 - 5. All pipe, fittings, valves, and accessories shall be carefully lowered into the trench by means of derrick, ropes, or other suitable equipment in such a manner as to prevent damage to pipe and fittings.
 - 6. Under no circumstances shall pipe or accessories be dropped or dumped into the trench.
 - 7. While laying pipe is NOT in progress, the open ends of the installed pipe shall be closed to prevent trench water from entering into the interior of the pipe. Adequate backfill shall be deposited on pipe to prevent floating of pipe. Any pipe that has floated shall be removed from the trench, cleaned, and re-laid in an acceptable manner. The use of burlap, wood, or other similar temporary plugs will not be permitted.
 - 8. No pipe shall be laid when, in the opinion of the Owner's Representative, the trench conditions or the weather are unsuitable for such work.
- B. Field Cutting Pipe
 - 1. Cutting and machining of the pipe shall be accomplished in accordance with the pipe manufacturer's standard procedures for this operation.
 - 2. Pipe shall NOT be cut with a cold chisel, standard iron pipe cutter, wedge type roll cutter or any other method that may fracture the pipe or will produce ragged, uneven edges.
 - 3. Pipe shall be square cut with fine tooth saw or other cutter or knife designed for use with plastic pipe.
 - 4. After cutting, the end of the pipe shall be beveled using a beveling tool, portable type sander or abrasive disc. Remove burrs by smoothing edges with a knife, file, or sandpaper.
- C. Field Joining Pipe Joints and Fittings:
 - 1. Pipe shall be jointed in compliance with manufacturer's printed instructions.

2. All pressure pipe shall be suitably restrained by use of thrust blocks or other means as approved by the Engineer.
3. Solvent Weld Joint Type Pipe
 - a. Test fit dry pipe and fittings before applying cement. Pipe should enter socket without forcing at least one-third but not more than two-thirds the depth of socket. Fittings that are looser or tighter shall not be used.
 - b. Thoroughly clean and dry the pipe end and socket of fittings prior to application of solvent.
 - c. Before applying cement, apply primer evenly to outside surface and end of pipe and inside surface of socket.
 - d. Apply cement evenly to outside surface and end of pipe and inside surface of socket. Avoid excess application of cement but insure complete coverage of all bonding surfaces.
 - e. Mark depth of socket on pipe to guide application of cement and insure full insertion of pipe.
 - f. Insert pipe in socket, twisting pipe or fitting approximately 1/2 turn as pipe is being seated in socket. Make sure pipe is fully seated providing a bond between end of pipe and shoulder of socket.
 - g. Immediately wipe excess cement from pipe leaving no more than a 1/8 inch fillet at fitting end. Hold assembled joint in place for approximately 15 seconds and allow to set for 30 minutes before moving. Avoid rough handling for 48 hours. Longer periods may be required in cold or wet weather.
4. Mechanical Joints
 - a. Cut off and remove bevel end of pipe before installing in mechanical joint.
5. Bends, Tees, and Reducers
 - a. Ductile-iron and/or PVC fittings shall be installed utilizing standard installation procedures.
 - b. Cable, rope, or other devices used for lowering fittings into trench shall be attached around the exterior of fitting for handling. Under no circumstances shall the cable, rope or other device be attached through the fitting's interior for handling.

3.04 COMPACTION OF PIPE BEDDING AND BACKFILL

- A. Compaction of pipe bedding and backfill material shall conform to the requirements of Section 02200.

3.05 TESTING

- A. Field testing of gravity sewer pipe shall be conducted and acceptability determined in accordance with of Section 15000 and Components and Section 15060.

****END OF SECTION****

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SECTION 15100 VALVES AND MISCELLANEOUS COMPONENTS

PART 1 - GENERAL

1.01 SUMMARY

A. This Section includes valves and miscellaneous items to be installed in pipelines as follows:

1. Gate Valves
2. Air/Vacuum Release Valves (AVRV)
3. Pressure Relief and Surge Anticipator Valves
4. Pressure/ Vacuum Gauges
5. Mechanical/ Flexible Pipe Couplings
6. Flexible Expansion Joint

1.02 RELATED SECTIONS

A. The work of the following Sections apply to the work of this Section:

1. Section 09900 – Coating Systems
2. Section 15060 – Piping Systems

1.03 SUBMITTALS

A. Product Data, Shop Drawings, Samples: The following information shall be submitted in accordance with the requirements of General Conditions Section 2.5 – Submittals:

1. Gate Valves: Annotated Product Bulletins
2. Air/Vacuum Release Valves: Annotated Product Bulletins
3. Pressure Relief and Surge Anticipator Valves: Annotated Product Bulletins
4. Pressure/ Vacuum Gauges: Annotated Product Bulletins
5. Mechanical/ Flexible Pipe Couplings: Annotated Product Bulletins
6. Flexible Expansion Joint: Annotated Product Bulletins

B. Operation and Maintenance Data: Installation, operating and maintenance data in accordance with General Conditions Section 7.10 – Instructions and Manuals.

1.04 DELIVERY, STORAGE AND HANDLING

- A. All valves and miscellaneous items shall be packed, shipped, stored and handled in accordance with manufacturer recommendations.

1.05 PROJECT/SITE CONDITIONS

- A. Temperature is expected to vary from 25 degrees F to 100 degrees F. Relative humidity is expected to vary from 10 to 100 percent.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Gate Valves: Clow Valve AWWA C509 series (resilient wedge, non-rising stem, and double "O" ring seal) or equal.
- B. Air/Vacuum Release Valves (for potable water): APCO Model 142 or approved equal
- C. Pressure Relief and Surge Anticipator Valves: CLA-VAL Model 52-03, or approved equal
- D. Pressure/Vacuum Gauges: Ashcroft, Ametek, or equal
- E. Mechanical/ Flexible Pipe Couplings: Dresser, Romac, Smith-Blair, or equal.
- F. Flexible Expansion Joints: EBAA Iron Flex-Tend, or equal.

2.02 GATE VALVES

- A. Valves shall be of the iron-body, bronze-mounted, and resilient-seated solid-wedge type.
- B. Gate valves 3 inches through 16 inches in size shall be resilient-wedge or resilient-seated, double O-ring seal, and shall comply with AWWA C500 and AWWA C509, including applicable hydrostatic testing.
- C. Provide wrench nut and valve box for all buried gate valves.
- D. Gate valves smaller than 3 inches shall be resilient wedge, non-rising stem, and triple O-ring seal.
- E. Materials:

Components	Material
Body	Ductile Iron
Wedge	
3 inches and smaller	cast-iron
More than 3 inches	Ductile Iron, rubber encapsulated
Mounting	Bronze
Stem	Bronze, AWWA C500, Section 3.12

Seat rings	Bronze, Grade A, AWWA C500, Section 3.8
Coating	Fusion-bonded Epoxy (both interior and exterior on body and bonnet)

F. Construction:

1. Exposed gate valves shall be rising stem type. Buried or submerged gate valves shall be of the non-rising stem type. Rising stem valves shall be provided with a stem collar stuffing box and packing gland with Teflon braid packing. Non-rising stem valves shall be provided with O-ring stem seals. The body shall be provided with screwed-on seat rings.
2. Gate valve end connections in exposed pipelines shall be flanged or threaded as shown on plans. Threaded ends shall not be provided on gate valves with end connections larger than four (4) inches. End flanges shall be integral with the gate valve body and be faced and drilled in accordance with ANSI B16.1 for 125-pound flanges. Gate valves in buried pipelines four (4) inches and larger shall be flanged or mechanical joint.
3. Epoxy coatings shall be applied in accordance with AWWA C550 and be NSF 1 Certified.
4. Prior to shipment from the factory, each valve shall be tested by hydrostatic pressure equal to the requirements of AWWA C509.

2.03 AIR/VACUUM RELEASE VALVES (FOR POTABLE WATER)

- A. Automatic combination air release valves shall be float operated, rolling seal or simple lever type designed to automatically exhaust air from piping under pressure and during filling and allow air to enter pipeline during draining. The valve shall be designed to withstand a working pressure of 200 psig. The air vent shall close drop tight, incorporating an easily renewable seat.

B. Materials:

Components	Material
Body, cover	Cast iron, ASTM A 126, GR.B or Reinforced Nylon
Linkage	Stainless steel
Seat	Buna-N or EPDM
Float	Stainless steel or Foamed Polypropylene

2.04 PRESSURE RELIEF AND SURGE ANTICIPATOR VALVE

- A. Component Elements: Include body with seat installed, the cover with bearings installed, and the diaphragm assembly.
- B. Provide valves that shall hydraulically control high pressures and power failure surges by bypassing system pressure that exceeds the high pressure control setting and also by opening a preset amount when sensed pressure decreases below a preset minimum in

anticipation of a surge. The valve shall close gradually to prevent further surges in the system.

- C. Where not indicated on the drawings, set valves open and relieve at a pressure 10 psi gauge less than the pressure developed in the closed system with the pump motor delivering the rated horse power.
- D. Pressure settings shall be easily changed in the field after connection without the use of special tools.
- E. Materials:
 - 1. Body: Heavy cast-iron or cast steel.
 - 2. Disc: Buna-N Rubber
 - 3. Disc Retainer and Diaphragm Washer: Heavy cast-iron or cast steel.
 - 4. Trim: Disc Guide, Seat, and Cover Bearing: Bronze.
 - 5. Diaphragm: Nylon Reinforced Buna-N Rubber.
 - 6. Stem, Nut, and Spring: Stainless Steel.
 - 7. Pilot System: Bronze ASTM B62 with stainless steel trim and Buna-N rubber.
- F. Pilot Control System: The pressure relief pilot shall be an adjustable, spring-loaded, normally closed diaphragm control designed to permit flow when upstream pressure exceeds the control setting. The low pressure pilot shall be an adjustable, spring-loaded, normally open diaphragm control designed to open when the sensed pressure falls below the control setting and closed when pressures are normal. The pilot system shall contain an adjustable hydraulic limiter to limit valve travel during low pressure opening without affecting high pressure relief valve travel.
 - 1. The remote sensor line connection to the main distribution line shall be a minimum of four (4) pipe diameters upstream of valve connection tee.

2.05 PRESSURE/ VACUUM GAUGES

- A. Type: Gauges shall be mounted on diaphragm seals.

All gauges shall have internal or external pulsation dampeners or snubbers. Gauges shall be 4-1/2-inch premium grade, glycerin filled units of the bourdon tube element type. They shall have 270-degree milled stainless steel movements, phenolic cases, shatterproof glass windows, and 1/2-inch NPT process connections. Uncertainty shall be no greater than 1 percent of span. All exposed metal parts shall be 300 series stainless steel.

- B. Diaphragm Seals: Diaphragm type chemical seals shall consist of a 316 stainless steel body with the diaphragm material to be determined by the manufacturer for the specific application. Seals shall be of the thread attached type and shall be provided with a purge connection.

- C. Pressure Sensors (Tubular Chemical Seals): Pressure sensors (tubular chemical seals) shall be of the full line-size type with an ANSI flanged or wafer type cast iron or steel body and flexible liner suitable for the service intended. A liquid filled cavity between the liner and the body shall transmit the line pressure to a diaphragm seal attached by a threaded nipple. The sensing medium shall be equal parts of ethylene glycol and water and shall be factory installed.
- D. Gage Taps: Unless otherwise shown or specified, gage taps shall be provided on the suction and discharge of all pumps having inlet and outlet piping larger than 2 inches in diameter and on the suction and discharge of all vacuum pumps, and air and gas blowers. All gage taps shall consist of 1/4-inch gage cock attached by a threaded nipple to the pipeline. The exposed threads of each gage cock shall be protected by a brass plug.

2.06 MECHANICAL/ FLEXIBLE PIPE COUPLINGS

- A. Sleeve-Type Couplings: Unless otherwise indicated, flexible type mechanical pipe couplings not intended to take tension shall be Smith-Blair Type 411, Dresser Style 38, or equal, with the stop removed from the middle ring. Couplings for connecting steel pipe to ductile iron pipe shall be Smith-Blair Type 413, Dresser Style 62, or equal.
- B. Restrained Flex Couplings: Where shown or where required to develop restraint to resist test and operating pressures provide restraint system in addition to the sleeve type coupling. Restraint system shall be Romac Series 611, Romac Series 470SJ, or equal.
- C. Flanged Coupling Adapters: Flanged coupling adapters shall be Romac RFCA, or equal. Provide restraint required to resist lateral forces.
- D. Grooved Couplings:
 - 1. Plain end pipe couplings shall be Victaulic Style 90, or equal.
 - 2. Grooved end pipe couplings employed for rigid jointing purposes shall be Victaulic HP70, Victaulic Style 741, or equal.
 - 3. Grooved end couplings for pipe jointing where flexibility is desired shall be Victaulic 77, or equal.
 - 4. Grooved couplings for ductile iron pipe shall be Victaulic Style 31, Victaulic Style 341, or equal.
 - 5. Coupling gaskets shall be suitable for the service conditions specified in the piping system specification sheets, Section 15060.
- E. Materials: All couplings shall be fusion epoxy coated. Hardware shall be 304 SS except hardware shall be 316 SS in moist, corrosive or submerged conditions.

2.07 FLEXIBLE EXPANSION JOINTS

- A. Ductile iron, consisting of integral expansion joint and ball and socket flexible joints.
- B. Minimum ball deflection: 3 – 12 inch 20 degrees

14 – 36 inch 15 degrees

- C. Internal surfaces lined with minimum 15 mils fusion bonded epoxy per AWWA C213. External surfaces shall be coated with catalyzed coal tar epoxy per AWWA C210. Provide polyethylene sleeves for direct buried applications.
- D. Provide flanged or restrained joints.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. General: Valves shall be installed in accordance with the manufacturer's instructions. Valves shall be independently supported to prevent stressed on pipe.
- B. Access: Valves shall be installed to provide easy access for operation, removal and maintenance and to prevent interferences between the valve operators and structural members or other obstructions.
- C. Miscellaneous Components: Install couplings and flexible expansion joints per the manufacturer's recommendations.

3.02 COATING

- A. Exposed valves shall receive final field coating as specified or in accordance with Section 09900 to match adjacent piping.

3.03 MANUFACTURER'S FIELD SERVICES

- A. The services of a qualified representative of the manufacturer of the control valves be provided to inspect the installation of the equipment, make any necessary adjustments, test and place the equipment in satisfactory operating condition.
- B. Provide minimum of 8 hours instruction, exclusive of startup services, to cover all the control valves including operation, components, maintenance, and troubleshooting. The City will have up to 5 individuals attend this training. The training may be videotaped by the City. The training session time and date will be scheduled with the City through the Owner's Representative.

**** END OF SECTION ****